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ANDREW CARNEGIE, PATRON OF LEARNING¹

By Dr. JAMES B. CONANT

PRESIDENT OF HARVARD UNIVERSITY

WITH this evening's dinner we end a celebration which I am sure you will all agree has been most impressive. We bring to a conclusion this century's formal salutation to the memory of a most remarkable man. Now I am not qualified even to attempt to evaluate the part Andrew Carnegie played in the industrial development of this country; nor am I sufficiently informed as to the history of philanthropic enterprises to try to estimate the magnitude of the results accomplished by his immense donations. But it is clear even to the most casual observer that on this occasion we pay tribute to a unique personality, a single individual who had original ideas and the ability and character to put them into practice. When in Carnegie's own words "he resolved to stop accumulating and to begin the infinitely more serious and difficult task of wise distribution," he made for his day a novel decision. He turned a corner, as it were,

and the Anglo-Saxon world following him looked at an old problem from a new angle.

Andrew Carnegie departed from the beaten track both in accumulating his wealth and, what is vastly more important, in disposing of it. I like to think that among the other objects he had in mind in the distribution of his money was the idea that for generations to come his own unorthodox actions might enable other men in entirely different walks of life to be equally original. As Mr. Keppel has said, Carnegie in the conduct of his business believed in the importance of finding the right man and then betting on him heavily. The same principle, to my mind, may be applied throughout the whole range of human activities. Unfortunately nowadays this is too often overlooked in our research institutes and our universities. The scientific director of a large and successful company once said to me, "We could burn all the specifications for making our products, we could sink all our plants to the bottom of the Atlantic, but if we kept

¹ Delivered at the Andrew Carnegie centenary dinner at the Waldorf-Astoria, New York, November 27, 1935.

the carefully selected staff we now have, we would succeed all over again. If we were to lose these men, however, all our plans and buildings and machinery would be of no use to us." If that is true of industry, how much more true it is of education and of research. Why bother too much about what is the most profitable field for future exploration or which of the many educational novelties seems best? Get the men, back them heartily, and very little else matters.

Andrew Carnegie, when he established the Carnegie Institution, clearly had in view not only the advancement of knowledge but the advancement of it by essentially the same practical method which he had used throughout his long business career—a method which made him suggest as his epitaph, "Here lies one who knew how to gather around him men who were cleverer than himself." The first two aims of the new institution which Carnegie established in Washington for the advancement of science were as follows (I quote from the deed of trust):

1. To promote original research, paying attention thereto as one of the most important of all departments.
2. To discover the exceptional man in every department of study, whenever and wherever found, inside or outside of schools, and enable him to make the work for which he seems specially designed his life work.

Would that these words might be engraved on the hearts of college presidents, deans and heads of departments—yes, and even on the hearts of presidents of great foundations, if Mr. Keppel will allow me to say so. Then there might be more hope that the present traditional stereotyped demands on our educational funds would diminish and the amount of fluid money available for the exceptional man would increase. There would be less talk of "new developments to be supported," less concern for the "most promising fields for exploration," less discussion of the "best projects for further study." There would be fewer schemes for the staff officers to mull over at headquarters, there might even be fewer staff officers.

One of the unfortunate results of the tremendous increase in the size of our universities has been the multiplication of administrative officials. And too often the men in these positions have been long divorced from active participation in research or teaching. They are out of touch with the fighting on the front line and their attention is too closely riveted to the maps and plans which lie on their tables. They fondly conceive that they have a clearer and broader grasp of what is going on than the captain in the thick of the fighting. A false analogy with business probably is responsible for the increasing number of non-scholarly executives who have been appointed to academic posts in recent years. But in

this connection the testimony of an eminent scientist who has long directed research in industry is of interest. Dr. Mees is reported to have said recently: "The best person to decide what research work shall be done is the man who is doing the research. The next best man is the head of the department [he was speaking of an industrial organization]. After that you leave the field of best persons and meet increasingly worse groups. The first of these is the research director who is probably wrong more than half the time. Then comes a committee which is wrong most of the time. Finally there is the committee of company vice presidents which is wrong all the time." When administrative officers themselves continue to devote a considerable portion of their time and energies to creative work and teaching, however, the situation is entirely different—the dangers of educational bureaucracy largely disappear.

To return now to the founding of the Carnegie Institution, this was a peculiarly interesting event for a number of reasons. It was an early recognition of the vital significance of research. More than a generation ahead of most business men of this country, Andrew Carnegie understood the importance of science to industry. He has told us in his autobiography about his very early realization of the value of a chemist to a steel mill—a revolutionary idea in the 70's. Undoubtedly his interest in pure science had its origin in such experiences. But after all, the essentials of the final scheme for the institution might have been written for him by others—such things have happened with benefactors. It is important to remember, therefore, that he refused to establish a National University at Washington, as Dr. White had advised him to do. He replied to White that "while this does, as you say, ensure immortality to the founder, it has hitherto seemed to me not needed, and this puts immortality under foot." His own alternative proposal, the Carnegie Institution, seems to have been the result of his personal conviction "that under present conditions greater good would result from cooperation with, and strengthening of, existing universities throughout the country."

A story in connection with the founding of the Carnegie Institution illustrates the theme which some of you may think I am over-emphasizing to-night. Just at the moment of the establishment of this foundation for advancing science, Carnegie refused a request to build a laboratory for a certain university, but at the same time saw to it that a substantial annual grant for research was given to the very promising young scientist whose solicitations he had refused. Knowing something of the history of this particular case, I can say with considerable assurance that as between the two alternatives, a laboratory or backing

the young man, subsequent events showed that Andrew Carnegie was absolutely right. He had picked a Nobel Prize winner fourteen years before the event!

Now Mr. Keppel has asked me a difficult question, perhaps one that is too difficult. Indeed, if it were any one else who raised this point I might suspect him of purposely hurling at me an unanswerable query in order to spike my whole line of argument. Mr. Keppel has asked, "How are we to find the man who is worth supporting? By what process are we to discover the exceptional man?" My answer is—by much hard work and a sixth sense; a sixth sense that some people, including Andrew Carnegie, have had. As a matter of fact, I am inclined to think that this sixth sense might be found on analysis to be fundamentally only a passionate interest in the kind of man you are looking for, and the keenest possible desire to find him. My real answer to the challenge behind the question is that it can be done because it has been done. And those of us who control the expenditure of money, whether as officers of foundations or research institutions or universities, must enlist the services of those who have this sixth sense and who are worthy successors to such great connoisseurs of young talent as President Gilman and President Thomas.

All who have read the biographies of the scientific men of Central Europe in the last century will have come across repeated reference to one Carl Kappeler, for thirty-one years president of the Board of Education of the Swiss Confederacy and the virtual ruler of the Technische Hochschule at Zürich. The long list of distinguished men who in their youth filled the scientific and mathematical chairs at Zürich prove that Kappeler, who made the appointments, was a master of his craft. He has been described as one remarkable for "the keen scent with which he knew how to find young outstanding talent." The writer of a biographical note says that "Although he consulted with the authorities in the various fields about the scientific proficiency of the candidates, when professorships were to be filled, with regard to their teaching ability upon which he rightly laid equal weight, he trusted entirely to his own judgment. He did not spare long journeys—turning up now in the lecture rooms of one city, now in another, in order to acquaint himself at first hand with the individuals in question. Almost always his choice fell on the right man." We can perhaps gain a little more insight into this remarkable educational administrator's sixth sense from a story related by Emil Fischer in his autobiography. This chemist at the age of thirty-two was spending a few days in a summer hotel where it so happened that Carl Kappeler was also a guest. Kappeler, on discovering that the young man's name was Fischer and that he was a German professor of chemistry, sent a

message to inquire which of the two cousins he might be, Emil or Otto, for as Emil Fischer remarks, "er war über die jungen Naturforscher in Deutschland ausgezeichnet unterrichtet." To be excellently informed about all the young men in academic posts is no simple task; but this evidence alone convicts Kappeler of being that sort of enthusiast who nowadays is encountered only among the readers who devour the news and gossip of professional baseball! A short time after this Kappeler offered Fischer the professorship at Zürich, and all who know anything of the debt we owe to Fischer's genius will score this invitation as one more mark of Kappeler's prowess as a judge of men.

If Mr. Keppel and I are fortunate enough to have a second Kappeler by our side and are wise enough to listen to his counsel, what shall we do for the exceptional man when he is found? Exactly what Kappeler did—give him an opportunity worthy of his promise. See that he teaches a course that is a little too difficult an assignment, see that he has a little more support in the way of money and men for research than he feels is justified; a little more support than he dares hope for, but not much more. In short, put him in a position of scholarly responsibility which will bring out all that is good in him, and then leave him alone for a number of years. Don't list the number of his papers or weigh his books; give him air and room to move and leave him to his own devices. The rivalry and criticism of his professional colleagues will supply any external stimulus that may be necessary. In this manner I believe the Johns Hopkins University was conducted in its opening years, thus initiating a new era in American scholarship and education.

There is one very disturbing and fundamental question that Mr. Keppel did not ask me—indeed one I am sure he would never think of formulating—but it is being asked to-day and many people are demanding the answer in an increasingly hostile tone. To all I have said thus far this evening, some would reply with one word,—why? Why should we try to find the exceptional man, why should we be interested in the future eminent scholar or great investigator, why do such men need encouragement, why provide them with facilities for their work? Hasn't there been enough research already—perhaps too much poring over old authors, too much digging up of ancient civilizations better left buried, too many discoveries in the natural sciences with their attendant inventions—the source of much evil in the world? Many are saying to-day—put on the brakes, slow down. They suggest that the human race has not yet reached a stage of moral development where it can wisely employ all this accumulated intellectual wealth.

An editorial writer in a leading scientific journal

recently used these words: "The very frailty of civilization may demand certain limitations on the freedom of investigation possessed by the man of science." This is a novel doctrine for an Anglo-Saxon journal of science and is significant of the trend of opinion. In the same article we find the ominous suggestion that "with the very continuance of civilization itself in doubt, something in the nature of a mobilization of scientific efforts in its support becomes an urgent need." The vision of the meeting of staff officers again comes immediately to mind. Must we have scientific planning for the advancement of science? Must we have a board of control which will direct the forward movement and perhaps even order strategic retreats when necessary, or indeed declare a complete cessation of the fighting if it is decided that the frailty of civilization has passed a certain critical value? Of course, if we began even to approximate such a situation, much of what I have been saying is quite beside the point. Our whole attitude changes at once. There is no need of trying to find the exceptional man under such circumstances, for he is by definition original and he will have novel ideas. History shows that such men never relish having their freedom limited even in the interests of civilization. Above all, we must not give him ample support without restraint; instead we may need to check him gently. His ambition will certainly be to "turn the corner" and Heaven knows what he may find there—quite possibly this sick society of ours may not be able to stomach it!

So, instead of exceptional men free to do what they want in their laboratories and free to write what they want in their libraries, we shall have clever workers without any imagination (and there will be no difficulty in recruiting this army). Then all the general staff will have to do is to give the orders. No crude, peremptory statements to do this or stop doing that. Those in command will merely have to draw their plans and then, by controlling the expenditure of money for research and salaries, they can have their ideas put into execution; or rather they can try to have them put into execution. If the gentlemen in control are interested only in relatively short advances in knowledge, the consolidation of positions as it were, they certainly will not fail. But the history of the last five centuries shows clearly that except in trivial matters such methods of directing intellectual activity can succeed only in checking it. If that is the real object desired, then there will not be the slightest difficulty.

I suppose the conflicting points of view in all such matters arise from different interpretations of history. Since the revival of learning in the Italian towns of the fourteenth century, man's spirit of intellectual

adventure has been periodically rampant. In spite of waves of reaction and persecution, there has been an ever-increasing interest in new departures, a restless ambition to push on. More and more man's "desire to know why and how" has been in the ascendency. That fundamental passion, curiosity, has been given free rein—a passion which Hobbes has described as "a lust of the mind that by a perseverance of delight in the continuall and indefatigable generation of knowledge, exceedeth the short vehemence of any carnall pleasure." To this human passion we owe the recapture of the world of ancient Greece and a constructive interest in the art and literature of ancient Rome. Many who may be inclined to deplore the results of man's recent curiosity in the fields of science would be loath to relinquish the fruits of the labors of the humanists in the fourteenth and fifteenth centuries. But the fundamental urge which drove those men to collect manuscripts, to learn Greek, to relive antiquity was exactly the same as that which two hundred years later moved Galileo to measure the swings of the cathedral lamp by means of his pulse beats. The patrons of learning were actuated by essentially the same motives as the men of wealth who have later supported scientific research. If one were to summon a demon to blot out all that has developed in the last six hundred years as a result of man's ungoverned curiosity, not only science but a large part of our knowledge of classical antiquity would disappear. Is there anybody who really believes that it would have been better if the intellectual outlook of the Middle Ages had not been transformed by the forces of the Renaissance?

In the introduction to his study of the seventeenth century, Basil Willey states clearly the fundamental question which must be answered by those who decry the advent of the modern world: "Do we or do we not approve the action of the Paduan professor who refused to look through Galileo's telescope?" he asks. "If we find that we condemn the professor," he continues, "we have already decided on the main issue." There are some intelligent, educated persons to-day who appear to take a position equivalent to that of not only applauding the professor but of wishing him brought back to the scene, armed with plenipotentiary powers to destroy the telescope or at least determine when and how it should be used.

Of course, there has been much evil attendant on the tremendous release of individual energy which has characterized the development of our modern civilization. Some are inclined in the present sad years to regard only the debit side of the ledger and conclude that intellectual and moral bankruptcy are inevitable. Much the same situation must have existed in Italy at

the opening of the sixteenth century. Many, many people who deplored the tremendous orgy of vice and corruption which was then rampant in even the highest circles must have been ready to wipe out all the advances of the two preceding centuries. Even some of those who were unmoved by the enthusiasm of a religious revival must have been ready to subscribe to the verdict of that austere priest who passionately declared, "The whole world is in confusion; all virtue is extinguished, and all good manners; no living light abroad, no one who blushes for his vices." They may well have cursed the memory of Petrarch, who had prized so deeply his manuscripts of Homer and Plato, and longed so ardently for the ability to read them. They may well have wished that he and his followers had never spread a knowledge of the Greek language and ancient philosophy and literature throughout the Italian peninsula. But even when we read of all the evils of that time and even when we are inclined to attribute them all to the revival of learning, do we wish to turn back the pages of history and erase what

the humanists accomplished? We who see the anarchy and chaos of those times only through the glass of history will confidently say no. Let us consider how three hundred years from now our present fearful falterings will be regarded. Will it be said that with the advancement of knowledge well under way and man's horizons just beginning to clear, the human race became so preoccupied with material ills that it succumbed to terror and, in the interests of security, curiosity was confined? Or will it be said that, frightened as they were and bowed down by much trouble and suffering, nevertheless in one country—the traditional home of freedom—men still retained confidence in the importance of the great intellectual adventure?

The next twenty-five years will probably answer these questions, although those who are alive may not understand the full significance of what transpires. To my mind a fair indication of the way the tide is running will be afforded by noting to what extent we are still interested in finding and supporting Andrew Carnegie's "exceptional man."

HOW CARS GO OUT OF CONTROL: ANALYSIS OF THE DRIVER'S REFLEXES¹

By Professor YANDELL HENDERSON

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A RECENT accident on a road by a lake in Switzerland—the most tragic and sorrowful event in the entire history of the motor car—challenges science. Accidents of this type are frequent. The conditions producing them exist in every modern car and every motorist. For the analysis and explanation of these conditions—particularly as concerns the reactions of the motorist—all that is needed is the application of well-established principles of neuro-physiology. Yet up to the present time no one appears to have made such an analysis.²

The type of accident is that in which the explanation commonly offered is that "the car went out of control." Yet in many cases subsequent examination demonstrates that the steering gear, motor and brakes were in good order.

In reality, it is the motorist who "goes out of control." Yet he acts in the only manner that his nature permits: the manner in which every human being always instinctively acts—and always will act—under the circumstances.

In all cars now, the throttle is controlled by the downward pressure of the motorist's right foot upon

a pedal. Any occurrence that causes him suddenly to press down hard upon that pedal opens the throttle wide and causes the car to leap ahead with maximal acceleration. If he is then forced by his own reactions to continue to hold his foot clamped down hard upon that pedal, the car drives ahead until it collides with some object sufficiently solid to stop it or until it is overturned or until the motorist is thrown out of his seat. If he is thrown out and his foot thus removed from that pedal, the car slows down or stops. If, on the contrary, he retains his seat to the end, the speedometer is generally found to indicate a high speed at the instant of final crash. The critical feature in these accidents is, therefore, the continued pressure of the motorist's foot on the throttle pedal.

Normally the motorist regulates the speed of the car and its starting and stopping by means of several highly artificial reactions developed in his nervous system through training and experience. When speed is called for, he obtains it by a steady pressure with his right foot: an act that through all the ages prior to the invention of the motor car was never before employed by man or any of his animal ancestors to produce either rapid acceleration or continuous motion.

If the motorist wishes to go more slowly or to stop, he calls into play another much more complex acquired reaction. He draws his foot back, moves it a few

¹ Presented to the National Academy of Sciences, November 18, 1935.

² For a discussion of motor accidents at the British Association for the Advancement of Science, see the (London) *Times* of September 11, 1935.

inches to one side, and then presses down upon another pedal. The two acts—that by which he induces acceleration and speed and that by which he slows and stops the car—are thus closely similar in form, yet diametrically opposite in purpose.

That the human nervous system generally functions well even under these highly unphysiological requirements is indeed remarkable in view of the observations of Pavlov on "conditioned reflexes" in animals. He finds that, when two closely similar stimuli or "conditions" are used to excite quite different reactions, serious nervous disturbance may result from the "dilemma." In the motorist two widely different "conditions"—one calling for acceleration, the other for stopping—are required to excite two closely similar reactions. Yet, these two acts are seldom confused, even in emergencies. The motorist very rarely mistakes the throttle pedal for that of the brake.

What happens in serious cases of "car out of control" is rather that another reaction is called into play: a reaction so powerful that it instantaneously abolishes all the motorist's acquired or "conditioned reflexes." This reaction is as instinctive as that of a drowning man who seizes any one that tries to save him and drowns both. In the motorist the reaction concerned is the "self-righting reflex" that is excited by any sudden severe disturbance of equilibrium. It is a complex reaction in which the head, body, arms and legs are all involved. When it occurs in the driver of a car, the impulse that dominates him is to steady himself in his seat. He grasps the wheel with his whole strength. His arms stiffen, and he is as likely to steer off the road as along it. Simultaneously, and as part of the same nervous and muscular complex, he performs another act so instinctive that in most cases he is entirely unconscious of it. His legs are forcibly extended, and his feet are pressed down hard. It is the muscular act that Sherrington, who discovered it in the dog, named the "extensor thrust."

In less technical language this means that any motorist, no matter how experienced, who is suddenly and severely jolted, instantly reacts to steady himself in his seat; and in so doing he presses his foot hard down on the accelerator pedal.

If then the first jump of the car sends it along a course where it meets other jolts and bumps in rapid succession, the driver tries in vain to recover the equilibrium of his own body. And, as part of this effort, he continues to press down on the pedal and thereby sends the car completely "out of control." So far as he has time to think at all, he is amazed at the way the car behaves; yet that behavior is entirely due to the pressure of his own foot on the pedal and the grip of his hands on the wheel.

This righting reaction to recover equilibrium, and

gain support for the body, is universal. It occurs in all animals. Even a newborn baby has it fully developed; and no training can eradicate its impulse. A cat, no matter how it is dropped, always twists its body around and lands on its feet. A man who slips on an icy pavement, or whose chair falls backward, instinctively tries to recover his balance. In all our ancestors through millions of years of rough-and-tumble life, this instinctive reaction has prevented many a broken bone and saved many a life. It is only now that the physiologically unwise adjustment of the pedal controlling the throttle of the modern automobile converts this instinctive reaction of personal safety into a reaction that often sends the motorist to disaster.

How completely the righting reaction may dominate a motorist is exemplified in an accident in which the following details were reliably established: At a cross-road a high-powered sport car, in which three young men were riding, struck some obstruction that gave it a severe jolt, but did not overturn the car nor break any essential part. The car then left the road, plowed six hundred feet across a field, leaving the ground at one place for twenty-five feet, and with the driver still in his seat crashed at high speed into a house.

In another accident that happened to come under my own observation, a young and inexperienced motorist in overtaking and trying to pass ahead of another car, "sideswiped" and locked with it. Both motorists then accelerated until they overturned one hundred yards further on. If, on the contrary, the power in both cars had been shut off, they would have come almost or quite to a safe stop in this distance.

In another case, directly reported to me, a lady was driving a small sedan at less than traffic speed, when a fast truck passed ahead of her. To give room she drove to the right until two wheels of her car went off the edge of the cement. In getting back on the cement, she accelerated and swerved over to the left side of the road; then still accelerating back to the right side; and finally at full speed to the left side again, where the car went off the road entirely and turned over.

It is quite certain that none of the four drivers included in these accidents could have explained why their cars behaved as they did. Nor could any of them, after the initial event, have removed the right foot from the throttle pedal. All that they were capable of doing—and in fact did—was to steady themselves in their seats by pressing down on that pedal, not merely with ordinary force, but with the whole strength of their legs.

In such cases as these there is an initial physical jolt. But even that is not necessary. In the records of accidents that I have examined, there are many in which the driver was first merely startled and re-

sponded—as every one normally does—by a momentary extensor thrust of his legs. The car jumped, thus jolting the driver, bringing his foot still more forcibly down on the pedal, and sending the car crashing into a tree, or another car, or through a railing, or off a bridge into a river. I recently saw a new car with an inexperienced driver jump forward, swerve, mount the sidewalk and smash against a telegraph pole. The perfect driver would not behave as he did; but even normal men and women often do. Many things may startle a driver who—with an apparently clear road ahead—is not paying very close attention. It may be a child or other pedestrian that suddenly appears directly in front of the car; or it may be another car cutting across or coming in from a side road. And thus startled he accelerates, instead of slowing down, and crashes into the other car or runs down the pedestrian.

On curves also a driver tends to feel himself out of balance, and often finds it hard to avoid increasing the pressure of his foot on the pedal, even when he realizes that his speed is excessive. This tendency to accelerate is one of the reasons that cars so often go off of curves and smash or turn over.

Such in brief is the explanation that physiology affords of why and how a car that is in perfect order easily “goes out of control.” It reveals a hitherto unsuspected interaction between the car and human nature. We can not change human nature—not in a million years, even under the “new conditions analogous to natural selection” that (according to Professor Raymond Pearl) our automobiles are now imposing upon us. The change must be made in the cars. Yet, if it is not to meet serious opposition, it must be so slight that the motorist will scarcely notice it.

Fortunately, the “righting or equilibrium recovery reaction” itself suggests a natural remedy. The extensor thrust must itself either cut off the ignition or close the throttle, and thus slow the car. There are indeed already—as I learn—several inventions filed in the U. S. Patent Office so designed that heavy pressure upon the accelerator pedal will close the throttle. Their inventors believe that a “car out of control” indicates that the driver has mistaken the accelerator for the brake. Be that as it may; any such device is open to the decisive objection that many motorists, when overtaking and passing ahead of another car, are accustomed to press heavily on the accelerator. If, in doing so, they happened to close the throttle, the result might be a head-on collision with a car going in the opposite direction.

It seems to me, therefore, that it will be best to leave the right foot to do its worst, as at present; and to arrange for the left foot to counteract it and provide safety. For this purpose there should be another

pedal for the left foot at the spot where that foot ordinarily rests when not applied to the clutch. Moderate pressure upon this safety pedal might blow the horn, as a means of accustoming the motorist to the use of this pedal. Heavy pressure on it should either counteract the pressure of the right foot on the accelerator and allow the throttle to close or it should turn another butterfly valve in the carburetor and shut off the power. Then, under an extensor thrust, the car would slow down instead of accelerating out of control.

It is one of the characteristic and reliable features of the extensor thrust of the legs that the two legs are always pushed forward and downward together. The thrust of the left foot affords, therefore, a reliable means of making the equilibrium reaction a means of safety, as it always has been in the past, instead of an ever-present cause of danger as it now is. It must do this by closing the throttle, not by cutting off the ignition; for interrupting the ignition with the throttle wide open would produce dangerously violent explosions in the muffler. A connection between the safety pedal and the accelerator or directly between the safety pedal and the carburetor involves no considerable mechanical difficulty.

Finally, in order to form at least a rough estimate of the importance of eliminating the “car out of control” factor in automobile accidents and fatalities, I have availed myself of the courteous permission of Mr. Michael A. Connor, Commissioner of Motor Vehicles, to examine the records of the State of Connecticut for the year 1934. Excellent as are the Connecticut statistics, neither these statistics nor any others contain as a separate class the “car out of control” accidents. The reason is, of course, that the peculiar feature of these accidents has not heretofore been realized.

It was necessary, therefore, to study the details of each accident, and in order to save time, the examination was confined to those accidents from which deaths resulted: 447 accidents, 470 deaths. It further appeared that for the accidents in which a pedestrian was the victim, the records generally are rather meager as to the behavior of the car. There are, however, enough cases in which the car mounted the sidewalk or went off its course to justify belief that the “out of control” element may be as important in accidents in which pedestrians were the victims as in those that killed only motorists.

The latter class of accidents which, with the aid of my assistant, Dr. L. A. Greenberg, I have studied in detail, included, during the year 1934, 191 fatal accidents. Among them we find at least 19 in which the accounts indicate clearly that the “car went out of control” essentially as described in this paper. The

details of these cases are very instructive. In six the driver suddenly saw another car directly in front of him and accelerated. In three, he lost control on a curve; and in three more he first touched another car or avoided a pedestrian, and then accelerated wildly and crashed fatally.

On this basis, and until fuller data are available, the element of "car out of control" may be taken as about 10 per cent. of all serious automobile accidents. Per-

haps when this element is more generally looked for, it will be found in much larger percentage. And, if this estimate is correct, the addition of a safety pedal to the present controls of our cars should effect a corresponding saving of life.

Whatever the percentage, this is certain: Until all cars are fitted with a safety pedal or some equivalent device, accidents similar to that referred to in the opening paragraph of this paper will continue.

OBITUARY

CHARLES R. BARDEEN—1871-1935

ON June 12 there died at his home in Madison Dr. Charles R. Bardeen, dean of the University of Wisconsin Medical School. Death was due to a pancreatic lesion which was followed by liver involvements. His passing closed a life rich in accomplishment and brought a profound sense of loss to his colleagues, associates and the thousands of students in all parts of the world who had come under his influence.

Although Dr. Bardeen was born in Kalamazoo, Michigan, his boyhood home was in Syracuse, New York. The father was an educator and planned his children's education with care. Before entering college the son was sent to the Teichmann school in Leipzig, Germany, where he remained for a year. He always credited this experience with having laid the foundations for clear reasoning and a certain method of direct approach to fundamentals which later characterized all his research, teaching and public activities.

In 1889 he entered Harvard University, graduating in 1893. He was immediately attracted to the opportunities offered by a new medical school, that of the Johns Hopkins University. He entered the first class of this newly established institution and received his M.D. in 1897. Since his name headed the class roll alphabetically he was actually the first person ever to receive a Hopkins' medical degree. Among his classmates were three others who have made national reputations: E. L. Opie, W. G. MacCallum and Richard P. Strong.

Following his graduation, Dr. Bardeen was appointed assistant in anatomy at Johns Hopkins, later becoming associate and then associate professor. In 1904 he was called to Wisconsin by President Van Hise to be professor of anatomy and to lay the plans for a medical school. The founders of medical education at the university were President-emeritus Birge and Dr. William S. Miller, who in the department of zoology had already instituted certain pre-clinical courses. Dr. Bardeen was the founder of the medical school. In 1907 the legislature authorized the establishment of a two-year school and the professor of

anatomy became Dean Bardeen. Around himself he collected a strong faculty. All the students were forced to do their clinical years at other institutions, but this quickly established the fact that unusually well-prepared young people were coming from Wisconsin. With the building of the Wisconsin General Hospital the full four-year medical course was established in 1925. Following this Dr. Bardeen secured the erection of the Service Memorial Institutes, the Student Infirmary and the Orthopedic Hospital.

In 1932, in honor of his twenty-fifth year of service as dean of the Medical School, the University of Wisconsin bestowed on him the LL.D. degree. At a banquet attended by many representatives of neighboring institutions, colleagues and students his portrait by Grenhagen was unveiled.

Dr. Bardeen was a scientist, an educator and an administrator. To these three fields of activity he brought enthusiasm and rare judgment. He thought continually of the problems confronting the physician, the student and the patient. He never spared himself and he was as free of ostentation as is humanly possible. The many honors that came to him were thus tributes to his real ability.

Dr. Bardeen's publications make up a list of ninety-six titles. The papers fall into two groups; those which are strictly scientific reports and those which deal with medical education. Among the former group are several that have far-reaching significance. His earliest work had to do with the changes following superficial burns and his observations are still quoted by all students of the subject. Many titles have to do with developmental and experimental morphology. He early made use of the x-ray and was one of the first in this country to study the effect of this form of energy on living cells. His scholarly work on the "Height-Weight Index of Build in Relation to Linear and Volumetric Proportions and Surface-Area of the Body" was published by the Carnegie Institution. This, as well as his study on the relation of heart size to body, might have opened up many physiological and clinical problems. He first proposed determining the size of the heart from its x-ray silhouette, a method

now in universal clinical use. In Morris's "Human Anatomy" he was asked to write the section on "Musculature," a tribute to his anatomical knowledge. All his scientific work has been accurate, authoritative and of permanent value.

As an educator Dr. Bardeen was not only a classroom teacher of power, but he closely studied educational problems from a social point of view. The student, the physician and the public always formed a trilogy of which he was keenly conscious. Each must be kept in balance and its right preserved. The right of the student was to be well taught; the right of the physician was to be independent and to have scientific medical help at hand; the right of the public was always to have the best possible medical care. Some such philosophy was at the bottom of all his writings and educational policies. His idea of a "preceptorship" for senior students depended on such principles. The student was not only profiting from an extensive clinical experience, but he was also serving as a stimulus to his preceptor. The Medical School was thus extending its teaching sphere to all parts of the state. The patient must ultimately benefit in this general uplift.

Dr. Bardeen's contributions to medical pedagogy have been notable. He introduced the use of the x-ray in teaching anatomy. His report made to the American Medical Association on the teaching of his science had a wide following all over the United States and Canada. His papers on the buildings and equipment of medical schools brought together much useful material.

Dr. Bardeen was a member and often an officer of many national scientific societies, among which were the American Medical Association, the American Association for the Advancement of Science, Society for Experimental Medicine and Biology, Society of American Zoologists, Society of Naturalists, Society of American Anatomists, Radiological Society of North America and the Wisconsin Academy of Science. In 1916 he served as president of the Association of American Medical Colleges. In 1920 he was honored by election to the presidency of the State Medical Society. In 1929 he participated in the White House Conference on Child Health and Protection and wrote the section on "Human Types." He also served for several years in the National Research Council.

Even with advancing years and constantly increasing administrative duties Dr. Bardeen never let his interest flag in medical problems. He was recently called upon to administer the Bowman Cancer Fund, and in preparation for this he visited the principal eastern research centers. Those who accompanied him never ceased to marvel at the many friends he found, the quiet direct manner with which he secured

valuable information and the understanding he developed of the many aspects of the cancer problem.

With all his duties, Dr. Bardeen found time for local social undertakings. He served as president of the Madison General Hospital Association, and under his leadership the west wing of that institution was built. He was one of those largely responsible for the establishment of the University Club and he was for a time its president.

Dr. Bardeen was twice happily married. Three sons and a daughter survive the first marriage and his widow and a daughter the second. Although not interested in the usual routine of society, Dr. Bardeen was never happier than when entertaining a group of friends in his home. His conversational powers and his broad interests made him the most agreeable of hosts.

Dr. Bardeen's scientific studies, his plans for medical education and his development of a well-rounded successful medical school are his permanent contributions to the university and the state.

WALTER J. MEEK

CHARLES LOOMIS DANA

DR. CHARLES LOOMIS DANA, born in Woodstock, Vt., in 1852, died at Harmon-on-Hudson, on December 12, 1935, aged eighty-three years. He was one of the earliest and most distinguished neurologists in America, and had been professor of nervous diseases at Cornell Medical College since 1899. He graduated from Dartmouth in 1872 and in medicine from Columbia in 1877. In later life he received the honorary degree of doctor of laws from his alma mater and also from the University of Edinburgh. He published a "Textbook of Nervous Diseases" in 1892. He naturally became president of the New York Neurological Society early in his career, and subsequently president of the American Neurological Association.

It is not often that a specialist is so outstanding in his profession as a whole that he would be singled out as a leader in medicine, but the Academy of Medicine of New York has twice in its long life elected a neurologist as its president—Dr. Dana in 1914-16 and Dr. Sachs more recently. Dr. Dana made many valuable scientific contributions to the progress of neurology. He was an unusually clear thinker and expositor of his ideas and a most excellent teacher. He was indefatigable as a student in his own field, and an accomplished scholar in areas outside of medicine, in history and literature. His intimates found him a kindly, genial, loyal friend, ready to help those in need of help and to further innumerable enterprises for the public good. He was always sincere, sometimes austere, but ever evinced a delightful sense of humor.

He will always be remembered by his professional friends and pupils, by his fellow-neurologists, and especially by that group of physicians with hobbies, known as the Charaka Club, of which he was one of the founders and in which lifelong friendships are begotten and ties made that are only severable by death.

In the published volumes of the Charaka Club, the following contributions by Dr. Dana will give an idea of his activities outside of his special field of neurology and so fix in the minds of his friends the catholicity of his interests: Vol. I, "The Cult of Aesculapius" and "The Evil Spoken of Physicians"; II, "The Medicine of Horace"; III, "When Apollo Strikes the Lyre"; IV, "The Costume of the Ancient Greek Physician"; V, "Military and Civil Surgery Among the Ancient Romans" and "Eminent Physicians: a Statistical Study"; VI, "Ursinus, the Father of Opothrapy" and "Sonnet to Clio (as Muse of Historical Medicine)."

FREDERICK PETERSON

RECENT DEATHS

PROFESSOR ALBERT SPEAR HITCHCOCK, principal botanist in charge of agrostology in the Bureau of Plant Industry, died suddenly of heart failure on December 16. He was returning from Europe, where he had spent four months in studying grass collections. He was seventy years old.

DR. E. HERSHEY SNEATH, for thirty-four years a member of the faculty of Yale University and since 1912 until his retirement in 1923 professor of the philosophy of religion and religious education, died on December 20 at the age of seventy-eight years.

PETER Z. CAVERHILL, chief forester of British Columbia for the past fifteen years and connected with forestry work in Canada since 1912, died suddenly on December 8 at the age of fifty-one years.

SIR RICHARD GLAZEBROOK, director of the National Physical Laboratory at Teddington, England, from 1899 to 1919, and chairman of the Aeronautic Re-

search Committee from 1908 to 1933, died on December 16. He was eighty-one years old.

Nature reports the death on November 30 of J. D. Cormack, regius professor of civil and mechanical engineering in the University of Glasgow, aged sixty-five years, and of Professor J. E. A. Steggall, emeritus professor of mathematics at University College, Dundee, in the University of St. Andrews, on November 26, aged eighty years.

MEMORIALS

ACCORDING to *Nature*, a representative Oxford gathering met in the Divinity School on November 20 to do honor to the memory of Robert Hooke, of Christ Church, who was born three hundred years ago. Dr. R. T. Gunther, reader in the history of science, presided. The warden of New College gave an address on the earliest "Oxford Movement," that resulted in the formation of the Royal Society and, in particular, on the activities in science and art of Hooke and Christopher Wren in London during the reign of Charles II. Accounts were read of Hooke's activities in geology and other subjects. The dean of Christ Church recalled some of the admirable qualities which Hooke showed as a man. He afterwards opened an exhibition devoted to Hooke's work, arranged by Dr. Gunther in one of the rooms of the Old Ashmolean Building. Professor F. Soddy had had prepared many models to illustrate different modern applications of Hooke's joint.

THE *Journal* of the American Medical Association reports that physicians from nineteen countries met recently at Poppi (Arezzo province) to honor the memory of Dr. Francesco Folli, who was the first to employ blood transfusion. Born at Poppi in 1624, this physician, in his publications "Recreatio physica" (1665) and "Dialogo sulla cultura delle vite" (1670) explained his idea of transfusing the blood of young and healthy persons to old or sick persons and described the instruments needed for the intervention. The commemorative address was delivered by Professor Pazzini, of the University of Rome.

SCIENTIFIC EVENTS

SYMBOLS AND ABBREVIATIONS USED IN ENGINEERING AND SCIENCE

A NEW dictionary of letter symbols and abbreviations, the "language" of engineers and scientists, will be undertaken by a committee of the American Standards Association, it has just been announced.

Rapid coinage of new words and terms, and the adoption of many foreign words and phrases in the various fields of engineering and the sciences, demands

a new compilation of standard usage, according to the committee.

In spite of their great ramification, engineering and science are becoming more and more integrated and those working in one field find that lack of abbreviations or confusion in their use restricts and hampers their work.

The Committee on Symbols and Abbreviations has been reorganized and will begin at once the intricate

task of coordinating existing abbreviations and symbols, and rewriting the present standards into a comprehensive manual of letter symbols and abbreviations. The scope of the work reads: "Standardization of letter symbols and signs for equations and formulas, and abbreviations for use in publications."

In line with the procedure of the American Standards Association, the committee is anxious to see that every group which has a problem in respect to abbreviations and symbols in its own field be represented on the committee. Any group which has published its own standard for symbols is urged to submit a copy for consideration by the committee.

Because of the difficulty involved in writing this universal simplified language for all phases of engineering, the committee is urging those interested to send comments on the standards which have already been approved, and suggestions for useful new symbols and abbreviations which are not now included, to Dr. J. Franklin Meyer, National Bureau of Standards, Washington, D. C., chairman of the committee.

Twelve standards for letter symbols, abbreviations and graphical symbols have been developed by the technical committee of the American Standards Association, which has been at work for many years. Recently, in order to simplify the work of the committee, it was divided into two parts, one covering the letter symbols and abbreviations, and the second covering the graphical symbols.

The committee working on letter symbols and abbreviations, which is now beginning its work, has twelve subcommittees covering the following broad subjects: mathematics, physics and mechanics, structural analysis, hydraulics, heat and thermodynamics, photometry and illumination, aeronautics, electric and magnetic quantities, radio, astronomy and surveying, and geodesy.

The committee which will prepare standards on graphical symbols will start work soon and will also request comments and suggestions on its phase of the problem.

THE NATIONAL RESOURCES COMMITTEE

THE National Resources Committee, of which Harold L. Ickes is chairman, appointed early in 1935 an advisory committee, which has now submitted a report.

Its recommendations are based on conclusions reached after a factual survey of pollution conditions and legislation existing for the control of pollution throughout the forty-eight states. The report indicates that many states are faced with increasingly serious pollution of their waters, that there is little use of uniform standards of water quality, that insufficient effort is being made to protect public health and

water fowl and fish life from the effects of domestic and industrial waste and that many states are lacking in legislation properly drawn to cope with existing conditions.

The six-point program presented for consideration aims at interstate control on the basis of drainage areas where possible, the simplification and coordination of state laws, broader authorization and adequate funds for research, the institution of a cooperative program of investigation to be carried on by legally constituted state agencies acting together with an appropriate Federal agency and the holding in abeyance of changes in Federal law until experiment with a demonstration unit has indicated whether or not changes are desirable and feasible.

The demonstration unit recommended would be a Potomac River Conservancy District to be established to serve as a research unit in a special program of cooperation between the states of West Virginia, Virginia, Maryland and Pennsylvania and the Federal Government. Such a unit, according to the report, would not only aid in the solution of many serious pollution problems, but would serve as a training field for the development of scientific and administrative personnel trained for duty with other states. The report covers the problems of pollution in relation to public health, industrial waste treatment, standards of water quality, conservation of water fowl and fish life and state and federal legislation.

The committee is composed of seven technical and administrative experts with special training and experience in the field of water problems. Members appointed to work along lines recommended in the Water Resources Section of the National Resources Board report last December and the report of the Mississippi Valley Committee of October last, are as follows: W. B. Bell, biological survey, Department of Agriculture; Lieutenant-Colonel Glen E. Edgerton, Corps of Engineers, U. S. Army; A. C. Fieldner, Bureau of Mines; Elmer Higgins, Bureau of Fisheries; Thorndike Saville, Water Resources Section, National Resources Committee; R. E. Tarbett, Public Health Service, and Abel Wolman, Maryland State Department of Health. H. R. Crohurst, sanitary engineer of the Public Health Service, worked with the committee on special assignment by Surgeon General Hugh S. Cumming.

THE VALIDITY OF FEDERAL BIRD REGULATIONS

ANOTHER legal attack on federal regulations governing the shooting of migratory game birds has failed and a federal court has again upheld the restrictions on wildfowling, according to a statement issued by the Bureau of Biological Survey in commenting on the

opinion handed down by Judge J. Earl Major in U. S. District Court in Springfield, Ill.

Dismissing a bill of complaint asking that federal officers be enjoined from enforcing this year's waterfowl-hunting regulations, Judge Major declared that the plaintiffs had no property right in the migratory birds but "only such permissive privileges as the governmental authorities may decree."

Led by G. G. Brandenburg, president of the Illinois Sportsmen's Association, and including five of that state's hunting clubs, the plaintiffs had alleged that the enforcement of the regulations would cause a depreciation in the value of property which they had acquired as hunting grounds. The judge, however, pointed out that "those who spend large sums of money in the purchase of land and in improving and equipping the same for the hunting and taking of migratory birds must have done so with the knowledge, actual or implied, that they had no property right" in the birds.

The "matter in controversy," the judge concluded, was not the damage alleged to be sustained in property depreciation, but rather the restriction on the plaintiff's taking and possessing waterfowl. Damage or injury suffered because of decreased real estate values he considered "purely incidental or collateral to the object and purposes of the suit." Ruling that such damage could not be taken into consideration in determining the amount in controversy, Judge Major reached the conclusion that this did not exceed \$3,000 and was therefore outside the jurisdiction of the Federal Court.

This conclusion, together with the ruling that no property right justifying an injunction was involved, according to the judge, precluded the consideration of other questions presented, including the allegation that the regulations were made without regard to zones of temperature or to the distribution, abundance, economic value, breeding habits and migrations of the birds. Biological Survey naturalists who were in court prepared to present the data used in formulating the regulations, and local sportsmen who supported the conservation policies of the bureau were thus not called upon to testify.

This year's regulations were based on the results of extensive investigations showing that the alarming condition of the birds made a short season with severe restrictions the only alternative to a complete prohibition of hunting. Though interested primarily in the protection of the birds, the Biological Survey points

out that only the necessary restrictions indicated by the condition of the species are recommended, and the restrictions are for the purpose of perpetuating the sport of wildfowling rather than of interfering with it.

THE PRESIDENT OF THE AMERICAN CHEMICAL SOCIETY

DR. EDWARD R. WEIDLEIN, director of the Mellon Institute of Industrial Research, Pittsburgh, has been elected president of the American Chemical Society for 1937. Dr. Weidlein was nominated in a national poll of the 19,000 members. The final choice was made by the society's council from the four nominees receiving the largest number of votes. Dr. Weidlein will serve as president-elect during 1936.

On January 1, Professor Edward Bartow, head of the department of chemistry and chemical engineering in the State University of Iowa, now president-elect, will take office as president of the society, succeeding Professor Roger Adams, of the University of Illinois.

Dr. Weidlein was born in Augusta, Kansas, July 14, 1887. He was graduated from the University of Kansas in 1909, and received the master of arts degree in 1910. He was industrial fellow of the university from 1909 to 1912. He holds the honorary degree of doctor of science from Tufts College, 1924, and of doctor of laws from the University of Pittsburgh, 1930.

Dr. Weidlein became associate director of the Mellon Institute in 1916, after serving four years as senior industrial fellow. In 1921 he was named director. His research has been chiefly in the fields of heat insulation materials, hydrometallurgy, camphor and epinephrine. Recently he has devoted himself to the methodology of industrial research.

Dr. Weidlein was chairman of the fuel committee of the National Research Council in 1918, and is now a member of the central petroleum committee and of its division of engineering industrial research. He was a chemical expert to the War Industries Board in 1918 and 1919.

He is a past president and director of the American Institute of Chemical Engineers and a fellow of the American Association for the Advancement of Science and of the American Institute of Chemists, as well as a member of other organizations in this country and abroad. He is a trustee of the University of Pittsburgh and a director of the Forbes National Bank, Pittsburgh.

SCIENTIFIC NOTES AND NEWS

THE Penrose Medal of the Geological Society of America has been awarded to Dr. Reginald Aldworth Daly, Sturgis-Hooper professor in the department of

geology of Harvard University. It will be presented at the annual dinner of the society at the Waldorf-Astoria Hotel, New York City, on December 27. The

medal was endowed by the late Dr. R. A. F. Penrose in 1927 and is awarded by the council of the society only at such times as it may decide proper "in recognition of eminent research in geology and of outstanding original contributions or achievements which mark a decided advance in the science of geology."

THE Henry Grier Bryant Gold Medal of the Geographical Society of Philadelphia was presented to Dr. Isaiah Bowman, president of the Johns Hopkins University, formerly director of the American Geographical Society, on December 1. This was the first award of the medal, which was established in honor of the late president emeritus of the society, Henry Grier Bryant, explorer and geographer. Dr. William E. Lingelbach, professor of modern European history at the University of Pennsylvania and formerly president of the society, in presenting the medal characterized Dr. Bowman as "scholarly and original in research, philosophical in his thinking, and concerned with the influence of geography on institutions and on society."

THE Catherine Wolfe Bruce Gold Medal of the Astronomical Society of the Pacific has been awarded to Dr. A. O. Leuschner, director of the Students' Observatory of the University of California, for distinguished services in astronomy. The award is for the year 1936, and formal presentation probably will be made to Dr. Leuschner in January.

THE Prix Binoux of 1935 for the history and philosophy of science has been awarded by the Paris Academy of Sciences to Dr. George Sarton, editor of *Isis* and associate of the Carnegie Institution of Washington, for the published volumes of his introduction to the "History of Science." This is the second time that the academy has awarded the Prix Binoux to Dr. Sarton; it was first awarded to him in 1915.

THE Edison Medal for 1935 has been awarded by the American Institute of Electrical Engineers to Dr. Lewis B. Stillwell, "for distinguished engineering achievements and his pioneer work in the generation, distribution and utilization of electric energy." The Edison Medal was founded by associates and friends of Thomas A. Edison, and is awarded annually for "meritorious achievement in electrical science, electrical engineering or the electrical arts" by a committee consisting of twenty-four members of the American Institute of Electrical Engineers. The following have been recipients of the medal: Elihu Thomson, Frank J. Sprague, George Westinghouse, William Stanley, Charles F. Brush, Alexander Graham Bell, Nikola Tesla, John J. Carty, Benjamin G. Lamme, W. L. R. Emmet, Michael I. Pupin, Cummings C. Chesney, Robert A. Millikan, John W. Lieb, John White Howell, Harris J. Ryan, William D. Coolidge, Frank

B. Jewett, Charles F. Scott, Frank Conrad, Edwin W. Rice, Jr., Bancroft Gherardi, A. E. Kennelly and Willis R. Whitney. The medal will be presented to Dr. Stillwell during the winter convention of the American Institute of Electrical Engineers to be held in the Engineering Societies Building, New York, N. Y., from January 28 to 31.

THE title of doctor *honoris causa* was recently conferred by the University of Paris on Dr. B. A. Houssay, professor of physiology in the faculty of medicine in the University of Buenos Aires. Dr. Houssay recently gave the Dunham lectures at Harvard University and will make one of the general addresses at the St. Louis meeting of the American Association for the Advancement of Science.

ACCORDING to the *Journal* of the American Medical Association, a bust of Dr. Garcia Tapia, professor of otorhinolaryngology in the faculty of medicine at Madrid, and a bust of Dr. José Luis Lopez de Haro, were recently unveiled. Dr. Garcia Tapia's bust was unveiled at Riaza, Segovia, and Dr. Lopez de Haro's bust was unveiled in Almaden de Minas. Both physicians are living.

DR. GEO. H. SHERWOOD, curator-in-chief of education and honorary director of the American Museum of Natural History, was elected president of the New York Academy of Sciences at the annual meeting held at the museum on December 16. Vice-presidents elected were: George T. Finlay, Ross A. McFarland, Horace W. Stunkard and Elsie Clews Parsons. Dr. Marshall A. Howe, director of the New York Botanical Garden, delivered the address of the retiring president on "Plants that Form Reefs and Islands," and Dr. William Crocker, director of the Boyce Thompson Institute, showed motion pictures illustrating the effect of toxic and stimulative materials on plants.

DR. GEORGE FINLAY SIMMONS, a member of the department of biology of the University of Montana for the past two years, has been elected president of the university.

DR. EUGENE MAXIMILIAN KARL GEILING, associate professor of pharmacology at the Johns Hopkins University, has been appointed professor of pharmacology and head of the newly established department of pharmacology at the University of Chicago. Pharmacology has hitherto been included in the department of physiological chemistry and pharmacology. Under the new arrangement it becomes a separate department and the older department, of which Professor Fred C. Koch is chairman, has been renamed the department of biochemistry.

DR. HARRY E. HIMWICH, associate professor of physiology at Yale University School of Medicine, has

been made assistant professor of physiology at Albany Medical College, succeeding Dr. F. S. Randles, who recently resigned. Dr. Joseph L. Schwind, associate professor of anatomy at Georgetown University School of Medicine, Washington, D. C., has been appointed to a similar position at Albany, succeeding Dr. Donald H. Barron, who has resigned to pursue research at the University of Oxford.

PROFESSOR RUDOLPH CARNAP, an authority on the philosophy of science, a member of the faculty of the German University of Prague, will teach at the University of Chicago this winter. He and Professor Charles Morris, of the University of Chicago, this summer organized the International Congress for the Unity of Science, which met at the Sorbonne, Paris, in September.

DR. GEORGE F. LAMB, professor of geology at Mount Union College, has been given leave of absence on account of ill health. Dr. John Robert Cooper is serving as substitute professor of geology during the present academic year.

PROFESSOR KENNETH NEVILLE MOSS, professor of mining at the University of Birmingham, has been appointed to succeed Professor Walter Stiles as dean of the faculty of science.

At the University of London, Dr. Eric Boyland, since 1931 physiological chemist at the Research Institute of the Cancer Hospital, has been appointed university reader in biochemistry and Dr. V. B. Wigglesworth, since 1926 assistant in the department of entomology at the London School of Hygiene and Tropical Medicine, has been appointed university reader in entomology.

THE retirement from active service is announced of Professor Alfred Fischel, the director of the Institute of Embryology at the University of Vienna.

DR. LEWIS H. WEED, professor of anatomy in the School of Medicine of the Johns Hopkins University, and James Ford Bell, a business man of Minneapolis, have been elected trustees of the Carnegie Institution of Washington.

DR. JOSEPH I. LINDE, clinical professor of pediatrics at the Yale University School of Medicine, has been appointed health officer of New Haven, succeeding Dr. Leonard Greenburg, who recently resigned to become associated with the New York State Department of Labor.

V. L. HARPER has been made chief of the Division of Forest Management at the Southern Forest Experiment Station, New Orleans, La. Mr. Harper is being transferred from Lake City, Florida, where he was in charge of the naval stores investigations.

OWING to the removal of Dr. T. L. Guyton, the secretary of the Pennsylvania Academy of Science, to another state, Dr. V. Earl Light has been appointed acting secretary and communications may be addressed to him, care of Lebanon Valley College, Annville, Pa. The next annual meeting of the academy will be held at the State Teachers College, at Indiana, Pa., on April 10 and 11.

THE following appointments are announced in *Nature*, recently made by the British Secretary of State for the Colonies: F. J. Pound, to be agronomist, Department of Agriculture, Trinidad; N. H. Sands, to be agricultural officer, Malaya; F. W. Toovey, to be botanist, Department of Agriculture, Nigeria; W. E. Miller Logan, to be assistant conservator of forests, Gold Coast; A. C. Russell, to be assistant conservator of forests, Gold Coast; T. N. Wardrop, to be assistant conservator of forests, Nigeria; J. B. Alexander, to be geologist, Nyasaland; A. Cawley, to be engineering geologist, Tanganyika; W. H. Reeve, to be assistant field geologist, Tanganyika; B. N. Temperley, to be assistant field geologist, Tanganyika; W. J. B. Johnson, to be canning officer, Department of Agriculture, Malaya; A. A. Abraham, assistant agricultural superintendent, to be agricultural superintendent, British Guiana; G. W. Lines, lately superintendent of agriculture, to be superintendent of agriculture, Nigeria; T. H. Marshall, senior agricultural assistant, to be district agricultural officer, Tanganyika, R. J. M. Swynnerton, agricultural assistant, to be district agricultural officer, Tanganyika.

At the recent meeting of the Research Committee of the Virginia Academy of Science, grants in aid of research were made as follows: Dr. W. E. Bullington, of Randolph-Macon College, for the purchase of a camera attachment; Dr. M. J. Murray, of Lynchburg College, for the purchase of certain chemicals; Dr. C. C. Speidel, of the University of Virginia, for the purchase of motion picture film, and Dr. T. W. Turner, of Hampton Institute, for the purchase of certain supplies. Aid was also extended to Dr. E. P. Johnson, of the Virginia Polytechnic Institute, which obtained for him an apochromatic objective for photomicrographic work. The payments to Dr. Murray and Dr. Speidel were made by the American Association for the Advancement of Science under the new arrangement by which research funds may be distributed through the affiliated academies.

THE U. S. Biological Survey announces that co-operative agreements have been entered into with a land grant college and the Conservation Commission in eight states under which research and demonstration in wildlife management will be carried on. Each unit will undertake a major research problem, will assist

in finding solutions to technical problems arising in wildlife administration, cooperate with management demonstration of locally important species, and carry on extension and educational work as may be feasible. The men selected to carry on the work at the various colleges are the following: Harold S. Peters, Alabama Polytechnic Institute, Auburn; Dr. Paul D. Dalke, Connecticut State College, Storrs; Logan J. Bennett, Iowa State College, Ames; Clarence M. Aldous, State University, Orono, Maine; Arthur S. Einarsen, Oregon State College, Corvallis; Dr. Walter P. Taylor, Texas Agricultural and Mechanical College, College Station; Dr. D. Irvin Rasmussen, Utah Agricultural College, Logan, and Charles O. Handley, Virginia Polytechnic Institute, Blacksburg.

PROFESSOR W. PAULI, of the University of Zurich, will give a series of three lectures at the Carnegie Institute of Technology on January 13, 14 and 15 on theoretical physics. The lectures are part of a regular program of public lectures sponsored by the institution. Professor Pauli is in this country for a year at the Institute for Advanced Study at Princeton.

FOUR lectures, concerned with the nature of some major visual problems and with the biological arrangements which underlie their solution, will be given by Dr. Selig Hecht, professor of biophysics at Columbia University, at the New School for Social Research, New York City, on Wednesday evenings at 8:20 o'clock, on January 8, 15, 22 and 29.

DR. THOMAS M. RIVERS, of the Rockefeller Foundation, New York City, gave on December 10 the third lecture in the Smith-Reed-Russell series for this year at the School of Medicine of the George Washington University. The subject of the address was "Filterable Virus Diseases of the Central Nervous System."

THE United States National Committee of the International Commission on Illumination held its annual meeting at Engineering Societies' Building, New York City, on November 15. G. H. Stickney was reelected president and Professor H. B. Dates was elected secretary-treasurer. Messrs. Stickney and Dates were also chosen as U. S. Members of the I. C. I. Executive Committee. The committee approved, with only a few minor reservations, all the resolutions adopted at the meeting in Karlsruhe, Germany, last July. Professor C. D. Fawcett was reappointed director of the secretariat on lighting education and Professor H. B. Dates, of the secretariat on lighting practice. U. S. representatives were appointed for the new list of technical committees. Other plans were formulated in preparation for the convention which is scheduled to be held in Holland in 1938. The commission and the U. S. committee are both in prosperous condition and are

reported to be undertaking significant work of importance in the lighting field. Among recent accomplishments are the assurance of a satisfactory primary standard of light, the elimination of discrepancies in photometry, and a guiding outline of practice and regulations for aviation lighting.

ACCORDING to the interim report of the American Film Institute, a complete catalogue of educational films in the United States has been prepared. By carefully checking the United States copyright records for a number of years, and lists of commercial, scientific, school, governmental, amateur and other groups, it was possible to locate more than 1,800 sources for films that have more or less educational value. A film catalogue card was prepared covering about 100 items and representing the consensus of opinion of many persons using or producing films. The United States Office of Education, through the courtesy of Dr. John W. Studebaker, commissioner, cooperated with the council in sending out about 10,000 of these cards. As they are returned by the film owners, the information will be carefully indexed, and for the first time in this country there will be accumulated a large body of information on all existing films suitable for education. Both the Office of Education and the American Council on Education desire that wide use be made of this information and therefore various types of film lists will be prepared. Steps will be taken to keep this film information up to date by a careful check on all new films. From such lists committees, such as the one in physical education, will be able to obtain information quickly about all films available in a given field. This information will also be of great value to teachers, administrators, CCC Camp advisers and others who use films as instruction aids.

THE Air Hygiene Foundation of America, Inc., has been formed by a group representing various industries, with headquarters at Thackeray Ave. and O'Hara St., Pittsburgh, Pa. The purposes of this organization are to conduct investigations of and to stimulate research on problems in the field of air hygiene and to gather and disseminate factual information. It will also cooperate with and assist other agencies active in this field and will collaborate in the coordination of such research efforts. A comprehensive investigation has been begun at Mellon Institute of Industrial Research, Pittsburgh, sponsored by the Air Hygiene Foundation, in which the hygienic, technologic and economic aspects of air contamination, especially by dust in the industries, will be studied. H. B. Meller, who has been appointed managing director, will carry out the investigation. He will be aided by Dr. F. F. Rupert, an industrial fellow since 1913, specializing in the field of physical chemistry. The medical adviser will be Dr. Samuel R. Haythorn, professor of

preventive medicine in the School of Medicine of the University of Pittsburgh and director of the Singer Research Laboratories.

At the annual meeting of the Association of Consulting Chemists and Chemical Engineers, held on October 22, several members brought up the definition of the term "scientific opinion" employed in the Cope-land Bill. This bill, which provides for food and drug regulations, has passed the Senate and now rests with

the House Committee on Interstate and Foreign Commerce. In it the term "scientific opinion" is defined as "the opinion, within their respective fields, of competent pharmacologists, physiologists or toxicologists." Believing that this definition is inaccurate and narrow the association passed a resolution suggesting the substitution of the present definition by "Scientific opinion is the opinion, within their respective fields, of competent specialists in the basic or applied sciences."

DISCUSSION

GEOLOGICAL MAPPING OF THE OCEAN BOTTOM

It is becoming more evident all the time that in the long neglect by geologists of the study of the ocean floor a gold mine of information has been left untouched. The common belief among geologists that the continental shelves represent great piles of sediment built out from the lands onto the deep ooze and clay-covered ocean basins has naturally deterred stratigraphers from attempting to trace the rock formations of the ocean floor. While this belief will probably continue to be taught to budding geologists for another generation, it is perfectly evident to all of us who are investigating the problem that there are extensive areas of rock bottom on the continental shelves, on the continental slopes and even on the deep ocean floors. Reports of rock bottom have been made for years by the various coastal surveys of the world and various fragments of the rock have been brought up from time to time, including some dredged by the writer. In the summer of 1934 H. C. Stetson, of Woods Hole Oceanographic Institution, succeeded in breaking off fragments of rock from a submarine canyon wall with fossils of definite age. During the past summer, working with the Scripps Institution and later with the California Fish and Game Commission boat, the writer, using similar equipment—that is, a heavy dredge attached to the boat by heavy wire—was able to obtain rock from five canyons off the California coast. Excellent fossils were dredged from the walls of the Monterey Canyon which preliminary examination have shown to be of Pliocene or Pleistocene age. Less certain fossils were obtained from the walls of La Jolla submarine canyon, but the character of the rock made it possible to establish the age as Eocene from comparison of nearby outcrops on land. Also, the age of the rock into which the canyon north of the Mexican Coronados Islands was cut appears to be Miocene or Pliocene on stratigraphic grounds. That rock is not difficult to find may be indicated by the fact that about four out of five of the attempted dredgings were successful.

It need not be supposed that these reports of what constitute real geological mapping of the ocean floor

come from very unusual localities which are especially favorable for such results. To be sure, the sides of canyons are good places to obtain rock, but soundings show that these submarine canyons are to be found around the continental margins off practically all coasts of the world. Judging from the success of dragging the walls of these canyons and also from the many reports of rock bottom by coast surveys on the shelves and slopes, it seems likely that a large part of the millions of square miles of territory included in the continental shelves and slopes may be added to the geologically mappable areas.

Regarding the deep ocean the problem is more complicated. Fragments of rock have been brought up by the various oceanographic expeditions from abyssal depths, although it has generally been assumed that these blocks represented erratics dropped by icebergs or floating vegetation. The blocks were always obtained while dredging for some biological purpose and as a rule have been thrown overboard or subsequently lost or at any rate neglected. There are reports of lava obtained from the deep Pacific. There should be good possibilities of obtaining rock by dragging up the sides of some of the precipitous slopes which echo soundings are showing to be not uncommon in the deep oceans. Probably dredging around the oceanic islands where there has been recent vulcanism would also bring up volcanic products.

It is interesting to speculate on the results which extensive dredgings would have on the geological science. It has often been said that the continental shelves probably contain many fragments of the stratigraphic record which were not preserved on land partly because of epochs when the inland seas were practically completely withdrawn. Now with the steep walls of submarine canyons, often many thousands of feet high, to draw upon, it is certainly highly probable that some parts of this lost record will be discovered. Incidentally new diving apparatus makes it perfectly possible to go down and look at these walls to depths of over a thousand feet and perhaps to as much as 3,000 feet.

One of the most debated problems in geology has been concerning the cause of similarities shown now

and in the past between continents and islands which are separated by deep oceanic barriers. If the ridges of the ocean represent submerged land bridges, it is highly probable that dredging their walls, which are proving to be very steep, will bring to light evidence of their former emergent condition. If, on the other hand, the continental drift hypothesis has caused the formation of parts of the ocean in recent times, no ancient formations should be revealed on the ocean floor in these places. In the same connection the nature of deep oceanic lavas has been the subject of much speculation.

The accumulated evidence in regard to submarine canyons has made it difficult to avoid the conclusion that these canyons were cut as a result of a lowering of sea level of at least 6,000 feet in not very remote times. If this sea level lowering has actually occurred, it should have left its imprint on the rock of at least the upper mile of the ocean floor. Dredging rock from various parts of the ocean remote from the localities where submarine canyons have been discovered will probably check this interpretation. Such things as weathered formation surfaces, the presence of pholad borings and the presence of shallow water incrustations would be evidence in favor of the general lowering.

These possibilities represent only a few of the results which may be expected from a program of intensive geological research in this new field. The time is ripe for geologists to join the oceanographers in the exploration of the seas.

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THE MAYA BREADNUT IN SOUTHERN FLORIDA

THE native flora of southern Florida is distinctly tropical, comprising hundreds of genera of forest trees, epiphytes and undergrowth plants that are shared with the West Indies and with the land of the ancient Maya civilization in southern Mexico and eastern Guatemala. Some of the Maya country is much like southern Florida, a succession of limestone reef formations, with swamps or sandy stretches between, though mostly covered now with dense continuous forest. Much of the interior of Florida is denuded and in the winter becomes very dry and frosty, but the need of restoring the forest cover is being recognized, and some of the Maya trees may contribute to the tropical reclamation. The Maya architecture is being imitated in northern cities, but in Florida could have a natural setting of palms and other stately trees, the same as in Mayaland.

One of the Maya trees that may be useful in Florida is *Brosimum alicastrum*, related to the true breadfruit

of the Pacific Islands, *Artocarpus communis*. Though most of the breadfruits are seedless, other varieties have large starchy seeds that are boiled or roasted and taste like Spanish chestnuts. The seeded breadfruits are called "breadnuts," and *Brosimum* shares this name in British Honduras and Jamaica, because the seeds are similar in texture and taste to those of the seed-bearing varieties of *Artocarpus*. The *Brosimum* fruits are single-seeded, but the trees bear well and the nuts are gathered by the Mayas for making their native bread when stocks of maize run low. The Maya name of the *Brosimum* tree is *ox* or *osh*, the same word being applied to the primitive taro-like root-crop, *Xanthosoma*, and to stocks of shelled maize kernels, although the general name for maize is *ixim*. An age of root-crops probably preceded maize culture, and an original use of *osh* for *Xanthosoma* may explain why this word also designates the numeral 3, the large "elephant ear" leaves of *Xanthosoma* being conspicuously 3-cornered.

Another outstanding Maya tree is *Achras sapota* or *Achras chicle*, hardly to be distinguished from the well-known sapodilla tree of the West Indies, that thrives in southern Florida and even escapes from cultivation, especially on the Keys. The chicle fruits are the same as sapodillas, russet-skinned, juicy and delicious, with the texture of high-quality pears. The chicle latex is the principal source of chewing-gum, and the wood has amazing durability, as shown by many chicle-wood lintels still in place over the ancient temple doorways, dating centuries back.

The chicle and breadnut trees are found in special abundance among the ruins of the Maya cities, and are largely responsible for the archeological discoveries of the last half-century. The chicle gum provided the inducement for exploring and cutting trails through the forests, while the breadnut foliage foddered the mules that carried the *chicleros*, and later the archeologists. At every forest camp breadnut trees are felled and the branches lopped for the animals to browse on the leaves and twigs. Such fodder is called *ramon* in Spanish, and this name is applied to *Brosimum* and to several fodder trees in other regions.

The ancient Mayas had no livestock, but may have gathered and stored the breadnuts, like breadfruits and taro in the Pacific Islands. The Maya cities were equipped with great numbers of subterranean storehouses, sometimes taken for water-cisterns, but small and flat-bottomed like primitive food cellars in other parts of the world. These are the so-called "chultunes," bottle-shaped, smooth-walled chambers eight to ten feet deep and nearly as wide, entered by a small central opening through the hard surface rock, fitted with a stone lid and sealed with clay.

In view of *Brosimum* being related to the bread-

fruit, and of the remarkable long-period storage of fermented breadfruit paste in the Pacific Islands, a study of food values and storage behavior of the Maya breadnut would be of agricultural and historical interest. The question naturally arises whether the early Maya civilization, that built so many large cities and occupied them for the long periods shown by the dated monuments, could have been supported by a migratory "milpa" agriculture like that of the present day, calling for a new forest clearing every year to grow the family maize crop. A use of long-lived, hardwood tree-crops would render the ancient Maya agriculture somewhat similar to that of the archaic "Golden Age" in the Mediterranean countries, where olives, figs, grapevines and pear trees were chiefly relied upon.

Forage or fodder may prove more important than food uses, if *Brosimum* becomes established in southern Florida, where, as in other tropical regions, dairies are difficult to maintain. Groves of large *ramon* trees are considered in the Maya country as the best pastures, the cattle being greedy for the fallen leaves as well as for the nuts. Also the trees may be tapped and the latex mixed with chicle or drunk like cow's milk, the natives reporting it good for nursing mothers and asthmatics. A related species, *Brosimum utile*, is the "cow-tree" of Venezuela, made famous by Humboldt as furnishing a potable latex, not to mention "cow trees" of other countries and of other botanical families. The Maya breadnut trees now growing in Florida, at the Plant Introduction Garden near Coconut Grove, were raised from seeds collected in April, 1922, in the district of Tikal and Uaxactun in northern Guatemala, and brought to Washington.¹

O. F. COOK

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SOME EUGENICAL ASPECTS OF THE INDIANS OF PISTE, YUCATAN

PISTE is a typical Maya village, located in the center of the political state of Yucatan. It is Indian in culture, modern medical science is practically unknown and nature is allowed complete freedom. In 1935 there were 415 inhabitants, of whom 207 were males and 208 females. The birthrate, calculated over a 17-year period, was 60.1 per M, and the deathrate 31.7 per M. The secondary sex ratio of 513 children born in this town was 108.5 males to 100 females. Births are attended by native midwives, and native medicinal practises are used. The average interval between births for 147 infants from 51 mothers was 28 months. Birth control is not practised in this community, and comparatively few abortions and stillbirths occur. The average number of children from 33 completed

¹ See *Official Record*, U. S. Department of Agriculture, May 17, 1922.

families was 6.69. The average age of mothers at the birth of the first child was found to be 18 years. This figure is based on exact birth dates. In this town there is only one woman over 25 years of age who is unmarried, and this is probably due to the fact that she is blind. Of the 513 children born into 109 families, 17.2 per cent. died before 2 years of age; of these 56 per cent. were males and 44 per cent. females. Not much can be said at present as to the life span of these people, since the birth dates of the older members of the population are not accurately known. It is the author's impression, however, that the older members do not live much longer than 60 years.

Since 1800 there have been two general migrations from the town. Before 1847 Piste was a thriving mestizo (Spanish-Maya cross) town. From that date to 1880 the town was completely unoccupied. This was during the War of the Castes. After 1880 it was reinhabited, increasing in population until in 1918 there were 474 inhabitants. About 1920 there was a political revolution which caused another exodus of 200 or more people, after which the population began to increase in numbers until in 1935 there were 415 inhabitants.

Naturally in these interior towns there is considerable inbreeding, and these 415 people can mostly be catalogued in the leading family pedigrees, e.g., Tun, Mex, Dzib, Ceme, Mis and Cauch. There are, however, no obviously feeble-minded people in this town.

In Piste during the 17-year period there were seven pairs of twins born and one set of triplets.

The diseases of the Maya Indians of Yucatan are considered at length in Publication 431 of the Carnegie Institution of Washington, and the social customs in Publication 448 of the same institution.

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TACONIC THRUSTING AND PALEOGEOGRAPHIC BASE MAPS

THE original position of early Paleozoic sediments in eastern North America has been altered by later folding and thrusting so that the present map gives a foreshortened base relative to ancient geography. This was recognized by Schuchert¹ in his spreading seaways to their interpreted original width on the present base. In this method, the position of early Paleozoic outcrops becomes anomalous with respect to the mapped distribution of the seas in which they formed. The writer has prepared a paleogeographic base map in which each of the principal Taconic thrust sheets in western New England has been stretched to overcome the foreshortening in its width. Then each slice has been moved back from the foreland

¹ C. Schuchert, *Bull. Geol. Soc. America*, 41: 704, 1930.

to the position from which it is believed to have been displaced. The resulting map displays the several slices in their relative original positions; paleogeography drawn on the base is realistic with respect to the width of seaways, and the present outcrops are

in their proper place in the ancient geography. A similar base map has been prepared for eastern North America.

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SCIENTIFIC BOOKS

THE DETERMINATION OF CRYSTAL STRUCTURES

International Tables for the Determination of Crystal Structures. Volumes I and II. Gebrüder Borntraeger, Berlin, cooperating with the Chemical Catalog Company, New York. 692 pages. 1935. 33 R.M. geh. 40 R.M. gebd.

THE tables have been prepared by an international committee of some twenty of the foremost x-ray crystallographers, under the editorship of C. Hermann, and with honorary editors, Sir William Bragg and M. v. Laue. As stated in the preface, the tables arose from the need for an international standard work with a nomenclature to which all papers on crystal structure might be referred. The aim is to put an end to the previous state of affairs, in which, in order to read the literature of crystal structure determinations, it was necessary to possess a knowledge of the many tabular works with their various abbreviations and different choices of axes and origins.

The unification of space group terminology has been accomplished by introducing the new system of Hermann and Mauguin. The great advantage of this system over previous ones is found in the fact that the symbol itself gives the complete spatial picture of the symmetry elements. Although the primary purpose of the tables is to present the new unified space group notation, advantage is taken of the opportunity to present a great deal of other information of considerable use to the x-ray crystallographer.

The first two chapters of Volume I explain the new nomenclature and correlate the new notation for crystal classes and space groups with the older schemes of notation. The next two chapters present the crystal classes, equivalent faces, translation groups and the various transformations of axes. Chapter V comprises the greater part of Volume I and presents the 230 space groups. Under each space group the following information is given: the Schoenflies symbol and the new symbol; the special positions; a diagram showing the equivalent points in the general position; a diagram giving the spacial arrangement of the symmetry elements; the point symmetry in the special position; the sub-groups; the structure factor, and the general vanishings. The tabulated structure factors for each space group will certainly be welcomed by all structure workers. In Chapter VI the space group

criteria are collected in the most suitable form for space group determination. The final chapters present the point symmetries of the special positions and a table of lattice complexes.

The second volume is devoted to mathematical and physical tables. A chapter on quadratic forms gives the necessary formulae, together with useful tables, such as $h^2 + k^2 + l^2$. The next chapter includes goniometric tables and the extremely useful tables $\sin 2\pi x$ and $\cos 2\pi x$ with x varying in steps of 0.001 from zero to unity. The value of these two tables for structure factor calculations can hardly be overemphasized. The next section includes a very useful summary of the more important intensity formulae, together with tables of atomic scattering factors, absorption coefficients, absorption factors, wave-lengths, glancing angles and atomic and ionic radii. The last chapter is on graphical methods. The choice of subject-matter in this chapter is rather poor, the relative amount of space and emphasis given to the different methods appears to bear no relation to the importance of the method in actual practise. For example, a more complete treatment of the methods of indexing Weissenberg patterns and full-page reproductions of the tetragonal and hexagonal Hull charts would have been decidedly more useful than Figs. 53 and 54, which are intended for graphical indexing of cubic powder patterns. Much of the material in this chapter should have been omitted.

As a whole the International Tables constitute an excellent piece of work, which can be most highly recommended. The material is well arranged and the figures and printing first class. The editors and contributors have worked hard to give the science of x-ray crystallography a unified system of notation; it is now up to the workers in this field to cooperate by adopting it.

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THE ANIMAL PARADE

Parade of the Animal Kingdom. By ROBERT HEGNER, assisted by JANE Z. HEGNER. New York: Macmillan, 1935. 675 pp., over 700 illustrations.

A DISTINGUISHED worker among the poor of London once remarked to me that when people became utterly

depraved, it seemed that the last good reaction which survived was the love of flowers. This deep-seated feeling manifests itself very early in life and perhaps may be described as essentially a love of beauty, of form and color. But the animal world adds a third element, that of movement, and all who have to do with children know how great is their delight in the activities of living things. The beauty, mystery and romance of animal life are inexhaustible, and their contemplation should be a constant source of delight throughout life. To the pageant passing before the unaided eye we now add the marvels revealed by the microscope and I well remember how, as a child, I regarded with extraordinary interest every puddle by the roadside after being shown the life in a drop of water.

There have been many natural history books, but there certainly was room for a new one, relatively complete and up to date, containing the many beautiful photographic illustrations which are now available. This has been supplied by Professor Hegner, and probably it will appear, when all his numerous services to education are recounted, that this work has been the most far-reaching in its effects. It begins with the Protozoa, including Volvox but not the Mycetozoa, and continues through the various groups, to end with the gorilla. We miss some interesting forms, such as Peripatus, and it would really seem that the closing chapter should have dealt with the Hominidae. The book seems remarkably accurate, and I have not found a single misprint. It is easy to point out various omissions; thus we are told that the San Jose scale appeared in 1880 near San Jose, California, but nothing is said of its origin. The sea-slugs are described as having protective coloration, but nothing is said of the splendid warning colors of certain genera. Such omissions are inevitable and presumably for the most part deliberate, to avoid increasing the size of an already large book. I do not quite understand why all the land slugs are described as "garden slugs." The information given relates principally to the habits of the animals, and it seems to me that the author has been remarkably successful in presenting an abundance of facts with a minimum of technical expressions. Some popular writers are so anxious to appeal to the unthinking multitude that they leave out the

materials for thought. Hegner has an entirely different aim; he wishes to stimulate thought and observation, and he knows full well that the active-minded young person will gladly enter the open door to mysteries at first (and indeed, at last) not fully understood. There is one matter concerning which I feel some doubt. The first chapter begins with a rather long pseudoserious account of Noah and his Ark, and the last ends: "Noah must have heaved a sigh of relief when the gorillas finally entered the ark and the gangplank was hauled in. We hope they all had a pleasant time on board. We know that every species landed safely on Mount Ararat, since it has been our privilege to describe their descendants in this book."

Now it is a fact that in my own case, Noah was associated with the beginnings of zoological knowledge. I had a Noah's Ark, full of animals carved in wood, and many a parade was staged on the nursery floor. Somewhat later, I used to lustily sing:

Oh, Noah of old he had an ark,
Hurrah, hurrah!
He set it afloat in Regents' Park,
Hurrah, hurrah!
And they all came marching in.
The animals came in one by one,
Hurrah, hurrah!
The elephant eating a penny bun,
Hurrah, hurrah!

And so on through many verses now forgotten. But in spite of this extreme levity toward Noah, I did not find him in my natural history books, and I do not think I wanted him there. I notice that the first part of Hegner's work is rather abundantly leavened by humorous allusions, but toward the end these seem to give out. On the whole I doubt their value, and prefer the more sober style. But I wonder whether this feeling will be at all generally shared by readers, young or old. Something might have been added concerning the use of moving pictures to depict the activities of animals. Such pictures will admirably supplement Hegner's "Parade," and will serve to further develop the interest which he has stimulated.

T. D. A. COCKERELL

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REPORTS

YALE LABORATORIES OF PRIMATE BIOLOGY, INCORPORATED

INCORPORATION in Florida of the Anthropoid Experiment Station of Yale University, which is located at Orange Park, Florida, is hereby announced and the

following summary statement is offered concerning the history, status and objectives of the establishment.

In 1925 Yale made provision for the systematic use of chimpanzees in biological research by creating as a section of the Institute of Psychology a Primate Labo-

1 Bo
Station
Found
by the
of Drs
Green
Wells

ratory. As a result of developments in this laboratory, the Anthropoid Experiment Station¹ was organized in 1929 as a subtropical breeding, observation and supply station, which, in addition to providing anthropoid subjects of known ancestry, age, life history and condition, should furnish opportunities, nowhere else available, for the study of varied problems of primate reproduction, genetics, behavioral adaptation, hygiene and pathology. Following the establishment of the breeding station the name of the New Haven and Orange Park laboratories was changed to "Laboratories of Comparative Psychobiology, Yale University." In connection with incorporation it was deemed desirable to indicate, by use of the term "primate biology," that the scope of the establishment is broader than, although inclusive of, psychobiology.

It is now ten years since anthropoid research was thus undertaken in the university. Initially four young chimpanzees, two of each sex, constituted the experimental group of the Primate Laboratory. During 1935 as many as forty individuals have been in use in the laboratories. A population census made on November 1, 1935, revealed six mature males, thirteen mature females, twelve children and adolescents and ten infants under three years of age. Of these forty-one chimpanzees, nine individuals, with a single exception immature, served as experimental group in the New Haven laboratory; one, a male estimated to be between thirty and thirty-five years old, was in the Philadelphia Zoological Garden as a loan exhibition specimen; and the remaining thirty-one specimens constituted the breeding colony in Florida.

The possibility of breeding and rearing chimpanzees in North Florida already has been demonstrated convincingly. Between the opening of the station in July, 1930, and November, 1935, fourteen normal births and nine miscarriages were recorded. With the exception of one pair of twins, all were single births. Thirteen of the infants listed as of normal, full-term birth are living and thriving at present either in Orange Park or New Haven. Of the reproductive mishaps, several should be charged to experimental requirements and a few, in the early history of the colony, to inexperience. The rate of population increase probably could have been at least doubled had experimental use of the animals been wholly subordinated to breeding requirements. Our accumulated and rapidly accumulating observations, when fully published, will importantly supplement available single case history studies by providing descriptive norms for the female sexual cycle (menstrual, swelling

and oestral), receptivity, mating behavior, gestational period and mother-infant relations.

Yale Laboratories of Primate Biology now own sixteen dated chimpanzees, so designated because ancestry, date of birth, and, with few exceptions, developmental history, experience, use in experiments and individual pathology are matters of reliable record. It is planned to replace as rapidly as practicable all members of the breeding colony whose age and history are unknown by dated individuals for whom such complete life-history records are available.²

The general objectives of this undertaking are four—naturally there are many specific aims and problems: (1) Improved availability and relative standardization of chimpanzee as material of research; (2) extension of knowledge of the biology of this primate type with resulting approximation to completeness of description, in order that the investigator may be fully acquainted with what he is using; (3) increasingly effective use of this animal in the solution of fundamental problems—morphological, physiological, psychological and sociological—for which human subjects should and would be used if it were practicable; and, finally, (4) achievement of maximal usefulness for each experimental subject as result of carefully planned and coordinated functional and structural studies.

The outstanding and immediate functions of the laboratories as contrasted with these general objectives are the satisfactory breeding, rearing, descriptive characterization and utilization of the chimpanzee in the extension of knowledge of life. A large amount of useful information already has been accumulated. In the early years of the laboratories problems of hygiene, health and handling tended to monopolize attention, whereas at present the urgency of practical demands has so far diminished that research is paramount.

Uniquely important in this connection is the life-history record of each individual subject. Manifestly an organism which serves as material in a study of organic function, and especially in neuro-, psycho- or socio-physiological investigations, can not be too intimately, inclusively and reliably known by the investigator. Usually an exhaustively detailed case history would be valuable, sometimes invaluable. For this reason attempt is being made in this establishment to press forward the boundaries of our knowledge of chimpanzee until it shall be known both comprehensively and thoroughly. When this has been achieved, the animal may be used experimentally with a degree of intelligence, assurance, convenience, economy of

¹ Both Primate Laboratory and Anthropoid Experiment Station have been supported generously by the Rockefeller Foundation. The Experiment Station has been guided by the wisdom of a Scientific Advisory Board, consisting of Drs. James R. Angell, Edwin G. Conklin, Milton J. Greenman, Frank R. Lillie, John C. Merriam, H. Gideon Wells and Clark Wissler.

² This experiment in the breeding and culturing of chimpanzee in the interests of biological research has been immeasurably advanced and quickened by gift from Mr. Pierre S. Abreu to Yale University of nine mature and four immature but dated chimpanzees from the Rosalia Abreu collection in Havana, Cuba.

effort and interpretability of results which at present are unapproached save in our research uses of certain relatively simple organisms, and which heretofore have commonly been considered unattainable for highly organized creatures like the anthropoid apes and man.

Scarcely less excusable in current practice than the use of inadequately known materials whose variability is extreme is the sacrifice of a valuable animal after employment in a single experiment or investigation. There are times of course when this is fully justified, even essential, but not rarely what amounts to inexcusable wastage of material results from lack of foresight in planning and arranging for sufficient inclusiveness of interest within a given laboratory. Accustomed as we are to sacrificing protozoan, invertebrate or lower vertebrate to a single experiment, we psychobiologists, and many another physiologist, act similarly when far more costly and difficultly obtainable subjects are in use.

The anthropoid ape, whether orang-outan, chimpanzee or gorilla, is the most suitable substitute for man in certain important inquiries. At maturity it repre-

sents a relatively huge investment by nature or by man. One might suppose that, dead or alive, every specimen would be highly prized and used in the most varied ways to advance knowledge. The opposite, however, actually is the case. From fairly ample information the estimate is hazarded that of all anthropoid apes captured ostensibly for educational or scientific needs, not one in twenty is ever employed in a really worth-while and well-conducted investigation, while of those which die in captivity not one in a hundred is used effectively for morphological investigations or either wholly or in part finds its way into an institutional collection. The wastage of our most expensive, and from various points of view our most precious, biological materials is unbelievably great. For this reason, among others, these laboratories are attempting to breed and culture chimpanzee so that it shall be as nearly as possible ideally available and useful in biological research.

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NEW HAVEN, CONNECTICUT

THE NATIONAL ACADEMY OF SCIENCES. III. ABSTRACTS OF PAPERS PRESENTED AT THE AUTUMN MEETING¹

*Anthropological excavations on Kodiak Island*²: A. HRDLIČKA. All studies on the origin of the American aborigines point to Asia as the source of their derivation. The basic identity of the American man, his unquestionable status as a variety of modern man, and the nature of his cultures, all point to a relatively late, post-glacial, peopling of America. The routes practicable for the coming of man from Asia to America, during the time such comings were taking place, were limited to Bering Strait, and possibly the Aleutian Islands. The newcomers must all, therefore, have passed over parts of Alaska, and they must have left there the remains of their stay. Such remains were the kitchen and house refuse with the bones of the fish, birds and mammals the people ate; cultural objects, especially those of stone, bone and ivory; and the skeletal parts of those of the migrants who died there. Such remains, in the Far North, are almost indestructible and should still be preserved in that region. The object of American anthropology and archeology is to locate these remains and learn what information they can give. Preliminary surveys of the regions in question revealed a great number of "dead" sites, some of which had been abandoned far back of the Russian times. But they revealed also serious obstacles to exploration. The main of these is the fact that the coasts, the rivers, the land in western Alaska have changed greatly during the last few thousands of years and are still changing. This

means that the location of the earlier remains will be very difficult, in a large measure in fact impossible. The second great obstacle is that the ground over most of the territory is perpetually frozen, which makes excavation exceedingly slow and difficult. The only favorable places for excavation are those on the southern shores of the Aleutians, of the Peninsula and of southeastern Alaska. They include Kodiak Island, and it is on this island that an undisturbed pre-Russian site of much promise was discovered. This site for three years and a half now has been excavated by the Smithsonian, and has yielded astonishing results. The human accumulations are up to 16 feet in thickness. They lie directly on glacial till and a layer of fine loess. They cover the period of perhaps 2,000 years. There were two different human occupations, with two different types of man and culture. The deep old type, while slightly Eskimoid, was in the main Indian. Its counterpart has been recovered from the deep layers of a huge mound on Frazer River, British Columbia. Its culture was both broad and artistic. The people domesticated the fox. They left signs of animism, fetishism and other mythical practises. They knew cannibalism and burnt human sacrifice. They were rather delicate physically, but free from constitutional diseases aside from arthritis. Their medicine men made use of human bones, and knew even the art of trephining. They paved with dressed slate slabs their lower lying habitations, and made slate-paved walks between their houses. They made jar-like receptacles from prepared clay, but

¹ Charlottesville, Va., November 18, 19 and 20, 1935.

² Illustrated by motion pictures.

did not bake them. They still used chipped stone implements to quite an extent, but gradually gave these up for polished. The acme of their art in ivory was reached in attempts at bas-relief portraits. They vanished suddenly and completely upon the advent of a physically stronger people of different head type, a few centuries before the advent of the Russians. The "Aleut" people who followed the old stock were a sturdier lot, but with simpler and differing culture. They too eventually vanished from the site, before contact with whites was established. The work on the site, carried on with the help of volunteer students, has yielded on one hand a large store already of original materials, and on the other hand has taught lessons of much importance.

The photodynamic effects of vital dyes on fertilized sea urchin eggs: D. H. TENNENT. The dyes used effectively in this work were Neutral Red, Brilliant Cresyl Blue and Auramine O. The experiments were done on the eggs of the sea urchin *Lytechinus variegatus*. Neutral red in concentrations of 1:150000, used on eggs 5 minutes after insemination, was non-toxic in diffuse light and on cultures exposed to sunlight for 2 minutes or less, while it was increasingly toxic to cultures sunned from 2 to 8 minutes and fatal to all normal development if the cultures were irradiated beyond 8 minutes. Following irradiation of from 12 to 20 minutes there was uniformly complete cytolysis, the surface of the egg forming a mass of colorless blisters. If the eggs were placed in the neutral red solutions after the nucleus had begun its processes of mitotic division and sunned from 2 to 8 minutes the eggs completed their division, but later development was abnormal. The effective light in the production of the photodynamic effect of neutral red was found to lie in the short waves of the visible spectrum. Cultures protected by a Wratten A No. 25 (Red) filter, and sunned, developed perfectly, and those that were screened from ultraviolet light alone were killed by an exposure of 20 minutes to sunlight. The action of brilliant cresyl blue is similar to that of neutral red. After irradiations of shorter duration both produce abnormalities in the phases of mitotic division. After longer irradiations both produce cytolysis. Auramine O in concentrations of 1:300000 and 1:600000 was toxic both in the diffuse-light and the irradiated cultures; in concentrations of 1:1200000 the eggs in the diffuse light cultures developed abnormally, while those in the sun-treated cultures failed to develop; in concentrations of 1:2400000, development of eggs in diffuse light approached normal. In concentrations of 1:4800000 development in the diffuse-light cultures was approximately normal, but was highly modified in those that were irradiated. The photodynamic effect of Auramine O was on the processes of mitotic division. The spindle was greatly reduced in size, was usually multipolar, and division of the nucleus was usually not followed by division of the cytosome. The multinucleate cell finally divided (fragmented) irregularly and cytolized. In concentrations that were on the border line between toxicity and non-toxicity in diffuse-light cultures, irradiation stopped all processes of development instantly.

The earliest responses of vertebrate melanophores: G. H. PARKER. Most fishes and amphibians begin to show color changes immediately after they hatch from the egg. No observations on this subject have been made on ovoviparous vertebrates such as the dogfish, *Mustelus*, whose young at birth may be as long as 33 cm. These young dogfishes when born are moderately dark, due doubtless to the influence of the maternal body in which they have been lodged. Immediately after birth they respond to their environment by changing light or dark through a concentration or a dispersion of their melanophore pigment. Pale bands can be produced by cutting the nerves in their fins and they blanch when adrenalin is injected into them and darken to an injection of pituitrin all as in the adults. They show no primary phase of color change, but are born with a melanophore system in the second phase, that is, in adult reactivity. The primary phase in them is apparently suppressed.

The manipulation of Hydra's nematocysts by Microstomum: W. A. KEPNER, W. C. GREGORY and R. J. PORTER. The polyp, *Hydra*, and the Turbellarian, *Microstomum*, feed upon each other. *Hydra* wounds or captures *Microstomum* only when the latter approaches it unawares. The *Microstomum* discharges from its pharynx a secretion that acts as a local anesthetic so that the polyp seems not to be disturbed when the worm is feeding upon it. The *Microstomum* eats the polyp primarily for its defensive structures, the nematocysts. The tissues of *Hydra* are digested within the enteron of *Microstomum*, leaving the three types of nematocysts (penetrants, glutinants and volvents) behind free of their cnidoblasts. These nematocysts are taken up by the endoderm and delivered to the mesenchyme. Here phagocytes ingest and digest the lasso-type of nematocysts (volvents) which would be of no use to the *Microstomum*. The penetrants and glutinants (stinging threads) are carried by phagocytes to the epidermis where, in cooperation with epidermal cells, the attending phagocytes (cnidophages) orientate the nematocysts and retain them indefinitely (for three or more generations). These orientated nematocysts are used by the *Microstomum* in wounding other animals that disturb it. So many cells of *Microstomum* cooperate in the manipulation of the nematocysts that one is tempted to remark that a *Microstomum* is all cooperation; as Weismann said that "a whale is all adaptation."

Virus concentration in relation to acquired immunity from tobacco ring spot: W. CONWAY PRICE. Tobacco plants infected with ring spot, a virus disease, invariably recover and become immune from the disease. Leaves from recovered plants, although difficult to distinguish from healthy leaves, continue to carry the ring spot virus. In the present study it was found that the virus of ring spot multiplies in recovered plants but never reaches as high a concentration there as it does in diseased plants. Leaves from diseased plants have, on the average, from 5 to 10 times as much virus as leaves from recovered plants. The decrease in virus concentration occurs suddenly since the healthy-appearing portions of partly recovered leaves

contains much less virus than the diseased portions of the same leaves. The virus concentration of leaves from recovered plants was not increased by inoculating them heavily with ring-spot virus. Roots of recovered plants likewise contain somewhat less virus than roots of diseased plants. Stems of recovered and diseased plants, on the other hand, were not found to differ significantly in virus content. The virus concentration of different leaves of both recovered and diseased plants was found to show a rather wide variation, whether such leaves were taken from the same or from different plants.

Increased mutation rate from aged Datura pollen: A. F. BLAKESLEE, J. L. CARTLEDGE and M. J. MURRAY.

Studies of the nature of rust resistance in beans: S. A. WINGARD. The results of studies conducted over a period of several years clearly show that varieties of beans, *Phaseolus vulgaris* L., differ greatly in their reaction to infection by the rust fungus, *Uromyces appendiculatus* (Pers.) Fries. On varieties commonly classed as rust susceptible, inoculation is followed by infection and the development of normal sori and spores. This, however, is not the case with the so-called rust-resistant varieties. On these, infection occurs, but the parasitized cells collapse as a rule before sori and spores are developed, thus producing sterile flecks in the tissues of the bean leaf. Hence, the so-called rust-resistant varieties owe their ability to resist the rust disease to their hypersensitiveness rather than to the property of true resistance or immunity. For all practical purposes, this type of resistance is satisfactory because the rust fungus can not produce spores in sufficient quantity on such plants to cause severe damage. Hypersensitive plants, however, can be killed by artificial inoculation with heavy doses of spores. In the case of the susceptible varieties, the invaded host cells are not destroyed by the rust fungus, but on the contrary are stimulated as a result of a symbiotic relationship formed with the fungus at the expense of the surrounding uninvaded host tissues. The rust hyphae spread from the point of infection through the tissues of the bean leaf and thus form circular colonies very similar in appearance to fungous colonies produced on artificial culture media. The colonies of invaded leaf cells, together with the invading rust hyphae, form the parasitic units which live at the expense of the other host cells. This symbiotic relationship between rust hyphae and invaded host cells continues until after spore production and the surrounding tissues are too much impoverished to continue to nourish the parasitic units. The rust hyphae then lose their ability to take the stain as if completely exhausted, whereas the invaded host cells seem to be invigorated as shown by the production of a green island surrounding the sorus. It seems that the invaded host cells prey upon the contents of the rust hyphae after the hyphae are weakened and partially exhausted by spore production.

Motion pictures showing some of the effects of alcohol on nerves in living frog tadpoles: CARL CASKEY SPEIDEL. Practically any degree of neuritis may be induced in

living frog tadpoles if these are immersed in dilute solutions of alcohol for suitable periods of time. The minute structural changes in single nerve fibers have been directly observed and photographed in the living animals during both irritation and recovery. Myelinated fibers irritated by alcohol exhibit vacuolation, fibrillation, swelling and globule formation. Severe prolonged irritation causes complete degenerative metamorphosis of the more distal myelin segments of a fiber. Mild daily intoxication of brief duration, even though continued for many weeks, causes little damage to nerves. The slight irritative changes that appear each day during treatments are quickly repaired. Under these conditions nerve growth continues, including myelin ensheathment of fibers and the origin and extension of new nerve branches. Growing nerve tips of regenerating fibers, as well as resting nerve endings supplying the skin, undergo definite retraction in alcoholized animals. Such retracted nerve endings grow out again soon after normal conditions are restored.

Conformal geometry: EDWARD KASNER. Just as projective geometry is based on the group of linear transformations, so conformal geometry is based on the group of all regular analytic functions of a complex variable. A single curve has no invariants, but a pair of curves at a point (curvilinear angle) has as fundamental invariant the angle θ between the tangents of the curves. The author has shown the existence in certain cases (namely θ a rational part of 360° or 2π) of differential invariants of higher order. In the case of $\theta = 90^\circ$, two relative invariants of third and fifth orders are found, and thus an absolute invariant of fifth order is determined. If, in hydrodynamics, we are given one stream line and one level line (of course meeting orthogonally), these two curves are not independent, but form a special type of curvilinear right angle, subject to an infinity of conditions. Three fourths of all the coefficients in the two power series are arbitrary. In the historically important case $\theta = 0$, giving a *horn angle* (two curves with a common initial tangent line), relative invariants of second and third order arise, and thus a unique absolute invariant of third order exists.

This invariant, which is defined as the "natural or conformal measure of the horn angle," is

$$M = I_3 = \frac{\frac{d\gamma_1}{ds_1} - \frac{d\gamma_2}{ds_2}}{(\gamma_1 - \gamma_2)^2} = \frac{r_1^2 \frac{dr_1}{ds_1} - r_2^2 \frac{dr_2}{ds_2}}{(r_1 - r_2)^2} \\ = \frac{\frac{d^2\theta_1}{ds_1^2} - \frac{d^2\theta_2}{ds_2^2}}{\left(\frac{d\theta_1}{ds_1} - \frac{d\theta_2}{ds_2}\right)^2} = \frac{\tan \delta_1 - \tan \delta_2}{(\gamma_1 - \gamma_2)^2}$$

where γ is curvature, r is radius of curvature, ds is element of arc, and δ is deviation. A concrete interpretation is obtained by drawing the two circles of curvature and the two osculating parabolas (or conics). For all circular horn angles the measure M obviously vanishes. If M does not vanish the horn angle can not be converted conformally into a circular angle. New invariants are obtained for higher order contact. Thus we obtain an intrinsic non-Archimedean classification of all horn angles.

For an orthogonal angle the simplest relative invariant is $\frac{d\gamma_1}{ds_1} + \frac{d\gamma_2}{ds_2}$, as contrasted with $\frac{d\gamma_1}{ds_1} \frac{d\gamma_2}{ds_2}$ and $\gamma_1 - \gamma_2$ for the horn angle. The bisection and multi-section of curvilinear angles is studied in detail. It is shown that any one of these relative or absolute invariants completely characterizes the conformal group, and that the results can be extended to any surface. New theorems are found concerning conformal symmetry with respect to any curve (Schwarzian reflexion), a process fundamental in the theory of functions (analytic prolongation). Finally families of curves are studied conformally. The entire theory is then extended dually to equiangular geometry, where many analogies and certain distinct features are displayed.

Continuous transformations on certain manifolds: G. T. WHYBURN.

On the computation of $\frac{1}{n!}$ to 400 decimal places, together with associated numbers: H. S. UHLER.

Periodic solar variation and associated weather phenomena: C. G. ABBOT. Stations 7,000 miles apart in opposite hemispheres agree to within an average daily difference of one third per cent. in values of the sun's intensity of radiation outside our atmosphere, and agree in showing the solar radiation to be variable. The solar variation, seemingly altogether irregular, is comprised of 12 regular periodicities ranging in length from 7 months to 23 years. These sum up to within an average difference of one fifth per cent. of the observed solar variation curve. These 12 periodicities are all aliquot parts of 23 years, which also is the sun's magnetic cycle. These solar periodicities are found in the temperature and precipitation of 6 widely separated cities of the northern and southern hemispheres during the past 100 years. Reversals of phase occur in these weather periodicities, and hitherto have obscured them. But these reversals occur abruptly at intervals which are integral multiples of 11½ or of 23 years from the year 1819. The 23-year cycle has been traced in the Pleistocene and Eocene geologic formations, in the widths of tree-rings, in the catch of ocean fishes and in the levels of the Nile River and the Great Lakes. A 46-year cycle is even more marked in Great Lake levels, and clearly associates itself with drought conditions. The 23-year cycle has been used to make test forecasts of temperature and precipitation for more than 30 cities in the United States for the years 1934, 1935 and 1936. The percentage results in 1934 were as follows: Excellent, 27; Good, 42; Half good, 17; Bad, 14. Publication of forecasts is withheld pending further tests.

The national mapping plan of the National Resources Board: WILLIAM BOWIE. To be published later.

Prismatic deviation as a function of cosmical orientation: F. L. WHIPPLE, T. E. STERNE and D. NORMAN. Measurements of the total deviation of light in a rigidly

constructed 2-prism astronomical spectrograph were made to detect any possible changes produced by azimuthal rotation of the instrument in its optical plane at various sidereal times. The deviation was found to be constant within the accuracy of its measurement. The determination of each "change" (due to a 90° or 180° change in azimuth) involved two least squares solutions, each depending upon 12 measurements of spectral lines on a photographic plate. The probable error, as determined from the least squares solutions, of a single "change" in the refractive index of the prisms should be 0.000000077 from errors of measurement. The observed probable error of a single "change" is 0.000000078. Thirty-six (36) "changes" were measured, and do not appear to be correlated with sidereal time, in any obvious manner. The mean of all the "changes" in the refractive index is $0.000000022 \pm 0.000000013$.

The proportion of dwarfs among tenth magnitude stars: P. VAN DE KAMP and A. N. VYSSOTSKY. Frequency distributions of the transverse motions of 3,000 faint stars with known spectra were investigated in order to obtain additional information concerning the relative frequencies of giants and dwarfs among tenth magnitude stars. This was especially desirable in view of the fact that the results recently obtained by Bok and van Rhijn and Schwassmann were contradictory to the conclusions of Schilt. The method used differed from those used by other investigators. It consisted of a very simple analysis of the frequencies of motions (H functions) corrected for the errors of observation. It was found in essential agreement with Bok and van Rhijn and Schwassmann that in both high and low galactic latitudes about 50 per cent. of the 10th magnitude G stars are dwarfs, while among the K stars the percentage of dwarfs is 19 per cent. in low latitudes and 35 per cent. in high latitudes. Grouping all stars together irrespective of their spectral class, it was found that 18 per cent. are dwarfs in low latitudes, whereas in high latitudes 35 per cent. are dwarfs.

New velocities of extra-galactic nebulae: M. L. HUMASON. During the past four years the apparent velocities of 100 extra-galactic nebulae have been obtained at Mount Wilson. They include velocities from 6 clusters, 5 groups and 56 isolated nebulae. As found in previous investigations they are predominantly velocities of recession ranging from only a few hundred km/sec. for the nearer and brighter objects, to velocities of the order of +40,000 km/sec. in the Boötes cluster and in the second Ursa Major cluster. Both clusters are estimated to be at distances of about 70 million parsecs. The observations cover a range about forty times that available in Hubble's first formulation of the velocity-distance relation and indicate that the relation is still sensibly linear out to the distance of these clusters. The constant of the linear relation, $v = 560$ km/sec. per million parsecs, remains essentially unchanged. In the Virgo cluster 25 new velocities have been obtained. These, with velocities previously known, show an average range of 500 km/sec.

around a mean of +1,200 km/sec. The apparent photographic magnitudes of the objects observed range from 10.0 to 15.0 and the mean velocity of the fainter members is approximately the same as that of the brighter. Velocities of isolated nebulae, including those previously known, have been used by Hubble and Humason to derive the velocity-distance relation for isolated nebulae. The relation parallels that for the clusters but is displaced one magnitude toward the brighter side. This displacement occurs because the nebulae observed were selected on the basis of apparent magnitude, a selection which favors the systems of high luminosity if the spatial distribution is considered. It is in the direction and of the order expected. Only six nebulae have negative velocities. Three of them, NGC 247, 253 and IC 342 are large and relatively near objects. The spectra of two others, NGC 4569 and NGC 6207, may be those of stars projected on the nuclei. Comparison of the spectral type with the nebular type shows that late-type spirals are decidedly bluer than E, Sa or Sb nebulae. The mean spectral types for these groups are: E0-7, G3.6; Sa, G3.4; Sb, G1.6; Sc, F8.8. The mean spectral type of faint nebulae is approximately the same as that of the brighter nebulae. The mean spectral type of the 100 objects observed is G2.5.

The magnitudes of 6284 stars in 350 regions of long-period variables: S. A. MITCHELL. The American Association of Variable Star Observers have under constant observation a large number of stars whose magnitudes are changing with periods fairly well known. The stars with periods greater than one hundred days are called long-

period variables. Our own sun is a variable star with a period of eleven years. Long-period variables are ordinarily observed visually by comparing the magnitude of the variable with two stars, one slightly brighter and one fainter than the variable. After the originator, this plan of observation is known as the Argelander method. To obtain the magnitude of a variable with accuracy it is necessary to have for each variable a sequence of comparison stars covering the whole range in brightness of the variable and to have accurately known magnitudes for each star of the sequence. The magnitudes of 6,284 comparison stars have been determined from visual observations with the 26-inch McCormick refractor both by observations with a wedge photometer and by visual sequences. By plotting the latter against the former an accordant series of magnitudes is derived. Comparisons of the magnitudes derived at the Leander McCormick Observatory, where the observational work was done chiefly by S. A. Mitchell, with similar magnitudes derived at the Vatican Observatory, show a high degree of accuracy. Comparisons of the visual magnitudes with those made by photographic processes and known as photovisual magnitudes, derived mainly at Harvard and Mt. Wilson, show a splendid agreement between the visual and photovisual magnitudes.

Biographical memoir of Eliakim Hastings Moore: G. A. BLISS and L. E. DICKSON.

Biographical memoir of John Ripley Freeman: VANCE NEVAR BUSH.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

ILLUMINATOR FOR CRITICAL MICROSCOPY UTILIZING AUTOMOBILE HEADLIGHT LAMPS

CRITICAL illumination for microscopy with high-power objectives requires a small (3 mm) source of both uniform and high intensity. This condition may be met admirably and economically by using a fine ground glass as a secondary source and focussing the light from a 6-8 volt automobile headlight lamp upon it. Replacement costs are almost trifling compared to the expensive ribbon filament, projection and other type lamps commonly used, while savings effected through decreased power consumption are considerable. Although a 32 candle power lamp will generally prove sufficient, both 50 c.p. and the double 32:32 c.p. bulbs are available where still greater intensity is needed as, *e.g.*, for photomicrography and dark-field illumination.

Certain types of commercial microscope illuminators have optical systems which are adaptable to the use of these headlight lamps, but when the light is concentrated to a small spot on the ground glass for the high power objectives, it no longer suffices to fill the low power field. This problem can be solved by the inser-

tion of a supplementary lens below the substage condenser,¹ by lowering the substage condenser or by the special feature incorporated into the optical arrangement in Fig. 1. The ground glass K (dashed line in

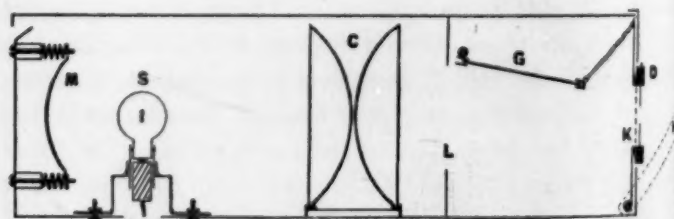


FIG. 1. Microscope illuminator in longitudinal section. Scale approx. $\frac{1}{16}$.

Fig. 1) for the small intense source and the iris diaphragm D are mounted in such a manner that their rotation from the vertical plane lowers a second ground glass G to intercept the converging light beam at L. Thus, merely by a quarter-turn of the handle H, a source of proper size and intensity for the low power field is obtainable. This extreme simplicity is dictated by the experience that accessories operated by more complicated motions are soon relegated to a state

¹ I. I. Kornhauser, *Stain Tech.*, 10: 91, 1935.

of "innocuous desuetude" by all but the most assiduous microscopists.

As to those details of mechanical construction which are subject to individual taste and preferment, only brief comments will be made. Fixed in position at C are the heavy condensing lenses of local length 14.0 cm and diameter 11.4 cm. The lamp socket, shown mounted on the bottom of the housing for diagrammatic convenience, is actually attached to the one side. With the socket free to move in a sleeve which is fastened to a vertically sliding base, the luminous filament may undergo the required rotational and two-dimensional adjustment in the transverse vertical plane. Coincidence of the direct and mirror images of the filament on the ground glass at K is secured by adjusting the three screws which support the concave mirror M on the rear wall of the lamp housing. The radius of curvature of the mirror is 5.6 cm. All focussing mechanisms are accessible from the outside.

For the low-voltage source, a transformer with a secondary tapped at 5, 6, 7 and 8 volts has proved convenient. This enables the light intensity to be readily controlled by a 4-contact dial-type switch. Where chromatic filters are employed, as is customary in critical investigations of many sorts, such intensity control does not appreciably alter the relative color values. Radio filament or toy transformers are obtainable at very reasonable prices from wholesale supply dealers and, if necessary, can be arranged in series or parallel, in order to supply adequate current at the proper voltage.

Since the above was written, valuable data on the operating characteristics of headlight lamps and filters have appeared in an article by Waterman.²

FRED M. UBER

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ELECTRO-ULTRA-FILTRATION APPARATUS

DURING the course of a study of mercury-protein solutions in which some of the mercury was bound in a non-polar linkage, great difficulty was encountered in freeing the solutions from an excess of mercury salts.

Precipitation of the unbound mercury usually resulted in a simultaneous precipitation of the protein-mercury compound. Ultra-filtration was very slow due to clogging of the membranes, and electro-dialysis could not be used on account of the relatively low rate of mobility of some of the mercurials. It was therefore necessary to devise a new means for the separation of unbound mercurials from mercury-protein compound.

The apparatus herein described was used successfully in preparing solutions of a number of protein-

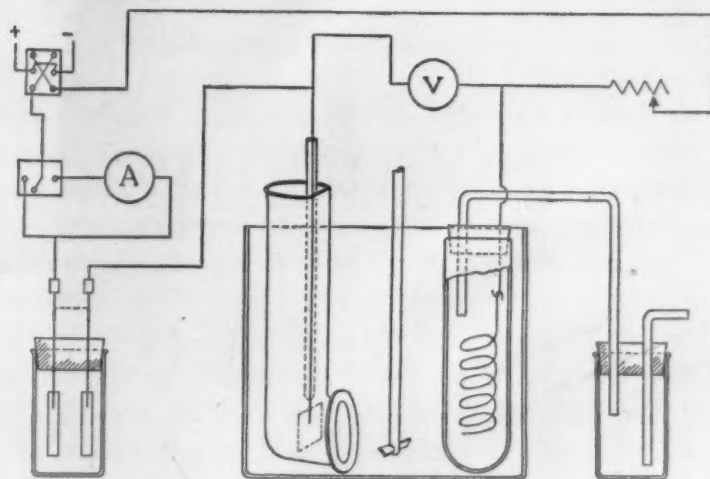


FIG. 1

mercury compounds. It consists (Fig. 1) of a collodion-covered alundum thimble containing a coiled platinum electrode and a wide glass tube with a short, wide Cellophane-covered side-arm containing another platinum electrode. The glass electrode chamber is left open for sampling. The alundum electrode chamber is provided with a close-fitting rubber stopper and a suction tube which is connected to a vacuum line. These two electrode chambers are dipped directly into the solution to be ultra-filtered. When current is applied to the electrodes, the gradient in potential between the two electrodes discharges the protein from the outer surface of the alundum thimble, and ultra-filtration can proceed without danger of clogging the collodion membrane.

In order to give the protein a negative charge, the solution must be kept on the alkaline side of the isoelectric point. This is accomplished by adding small amounts of alkali to the glass compartment containing the positively charged electrode. Should it be necessary to keep the solution on the acid side of the isoelectric point, the same result can be obtained by reversing the sign of the electrodes by means of a commutator.

Up to 115 volts can be applied if the entire apparatus is cooled in an ice bath. A.C. current can be used by cutting in a tantalum rectifier which has sufficient capacity for this type of work. The rectifier is easily made by immersing a 10 × 3 cm strip of tantalum in a 5 per cent. solution of sulfuric acid. A strip of lead can be used as the opposing electrode. A monomolecular layer of oxide on the Tantalum strip is effective in completely rectifying the current flow. An ammeter can be cut in to determine the current flow. The ultra-filtration proceeds with greater speed than does the concurrent dialysis. Nevertheless, the latter process is effective in speeding up the process of separation. Whereas only ions will be separated out of solutions in an electro-dialysis apparatus, small molecules and molecules having a small polar moment will be separated out by this apparatus.

² H. C. Waterman, *Stain Tech.*, 10: 113-26, Oct., 1935.

When separating out those metals which are normally deposited on the cathode, a direct analysis of the amount deposited can be gotten by weighing the cathode before and after completion of electro-ultra-filtration, provided the current applied is above the deposition potential of the metal being removed.

The collodion solutions can be prepared so as to give varying porosity according to the method of Bronfenbrenner.¹ An electro-ultra-filter has also been described by the same author.² However, the apparatus of Bronfenbrenner is costly, and does not provide for the collection and analysis of the filtrate-dialysate, nor for the discharge of the protein from the thimble. The essential feature of the apparatus herein described lies in the fact that the thimble is kept from clogging by means of the repulsion between the negatively charged protein and the cathode.

E. J. CZARNETZKY

THE UTILITY OF BROKEN AUTOMATIC PIPETTES

At a time when attempts are being made to utilize all waste materials, it is advisable that the broken glass apparatus in the laboratory be turned to some practical use. Below are described two pieces of apparatus which have been assembled out of two broken 25 cc automatic pipettes which were left unnoticed in an old storeroom for several years.

An automatic pipette consists of two parts: one is the calibrated portion which holds a known volume of the liquid and the other is the oval cap having an inlet for the air and an exit for the overflowing liquid. Most of the defects of the automatic pipettes are connected with the oval cap, which generally

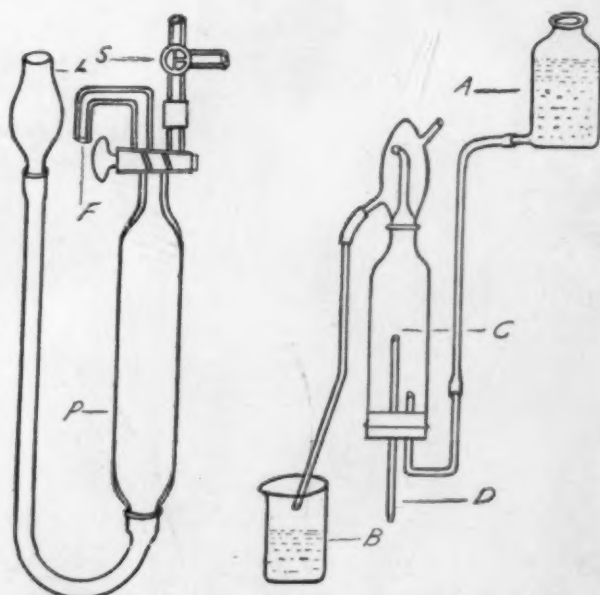


FIG. 1

FIG. 2

¹ J. Bronfenbrenner, *Jour. of Gen. Physiol.*, 10: 23-26, 1927.

² J. Bronfenbrenner, *Jour. Exp. Med.*, 45: 878, 1926.

becomes loosened and frequently breaks. An automatic pipette with a broken cap can be made into a very convenient gas sampler. Fig. 1 depicts the sampling apparatus as used with a Haldane's gas-analysis apparatus (portable form) in this laboratory. The portion P of the pipette is connected by means of a half-pressure rubber tubing with a 40 cc leveling bulb L. About 32 cc of pure mercury are introduced into the leveling bulb and thence into the sampling apparatus. A 3-way stopcock S is provided, one of the free ends of which is connected with the measuring pipette of the gas-analysis apparatus, while the other is utilized for expelling the gases from the apparatus. The end F is joined to the respiratory flask and sampling is done by the washing method. After three or four washings the sampling apparatus is put in communication with the measuring pipette of the gas-analysis apparatus and the sample is introduced therein.

Another trouble in an old automatic pipette is usually associated with the stopcock, which occasionally leaks, or the calibrated portion, which may break accidentally. Under such circumstances the broken pipette can be very conveniently utilized in the construction of a constant-rate dropping device for liquids (Fig. 2) which is very frequently needed in all physiological laboratories. The pipette is cut finely about the middle of the calibrated portion and the cut end is fused. A rubber stopper is introduced into this cut end. Through the stopper passes a tube D with a fine orifice below, and another tube is also inserted which connects the portion C with a small aspirator A. The overflowing liquid collects in the beaker B. The flow of water from the aspirator is controlled by applying a suitable clamp to the rubber tubing connecting the aspirator with the portion C. The number of drops delivered per minute varies with the bore of the dropping tube D, and minor adjustments are easily obtainable by pushing the tube D up or down. The apparatus was tested in this laboratory, and highly satisfactory results have been obtained.

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P. B. MATHUR

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BOOKS RECEIVED

- BEWS, J. W. *Human Ecology*. Pp. xii + 312. Oxford University Press. \$5.00.
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SCIENCE NEWS

Science Service, Washington, D. C.

LIGHT-WEIGHT AIRCRAFT CONSTRUCTION

IMPROVED airplane designs to take advantage of the already wide choice of strong yet light-weight construction materials should mark the progress of aviation in the next few years, according to Dr. L. B. Tuckerman, assistant chief of the Division of Mechanics and Sound, National Bureau of Standards, who gave the Marburg lecture before the American Society for Testing Materials meeting in Detroit.

As now built, Dr. Tuckerman said, airplanes take advantage of the full strength of the materials already known only in relatively small parts of the plane's structure. Aviation should take better advantage of the materials it already has instead of spending a great deal of effort to develop further stronger light-weight materials.

From purely structural considerations, there is little choice between the three types of aircraft construction now in use: wood, high strength alloy steels and light aluminum alloys. What choice there is must be based upon knowledge of designs which will make use of the greatest possibilities of the material, as well as ease of fabrication and resistance to deterioration.

Dr. Tuckerman pointed out that "with the best designs which have been so far produced it is possible to make full use of the strength of materials already available only in relatively small parts of the structure. The modulus-density ratio is still the limiting property of the material and this ratio is practically unaltered by any treatment which can be given a material. Consequently no radical improvement in light-weight construction is at present to be expected from still further increasing the strength of the materials."

Stressing the point that in better designs would be the greatest improvement, he continued: "There is, however, much room for improvement in the knowledge of the possibility of designing to utilize more fully the strength of materials now available. Systematic series of tests on typical structural elements, covering ranges of materials, over-all dimensions, wall thickness and types of loading, sufficiently wide to determine all the types of instability and plastic yielding which are likely to occur in practical designs, to determine the limiting conditions of each type, and their relations to the stress-strain properties of the material as determined by parallel coupon tests: systematic tests such as these offer present promise of materially improved light-weight construction. Tests of this kind are being carried out in many laboratories, but many more are needed if progress in light-weight construction is to be maintained." In conclusion, research in the field of light-weight construction of aircraft not only benefits the realm of aeronautics, but is being put to practical use in many other types of construction, notably in light-weight railroad trains.

A NATION OF NOMADS ON WHEELS

A PICTURE of the America of the future as a nation of nomads, with part of its population living in automobiles

without permanent residence was drawn by O. T. Kreusser, director of the Museum of Science and Industry of Chicago, who spoke at Detroit before the annual meeting of the American Society for Testing Materials.

"It may not be amiss to predict," Mr. Kreusser said, "that if present trends in buying cars or buying homes continue, an increasingly larger portion of our population will live and carry on their home and business pursuits more around the automobile and less around a house as a permanent abode."

"The day may yet come when many of us will solve the family problem of the higher cost of living and the reduced net income by spending the winter in the South, migrating with the birds, and by living on wheels; thus avoiding the existing dual cost and investment of home and automobile."

This would be the result of the continuation of present trends in the housing and automobile industries. According to Mr. Kreusser, in the housing industry during the past twenty-five years, "the quality of material and workmanship has, if anything, declined, in spite of double and trebled increase in cost. On the other hand, the automobile's apparent and actual value per dollar has made it, in the eyes of other industries and by comparison with other man-made products, an enviable acme of accomplishment."

Automobile trends and design are direct products of economic forces giving the tiny European car as an example of an attempt to lessen burdensome taxation. Instead of building smaller and less comfortable automobiles, he thinks that America will pay more attention to increased comfort, speed and general performance and "better utilization of the right materials distributed effectively."

Mr. Kreusser believes possible automotive improvements of the near future are: (1) Full air conditioning for greater comfort in winter and summer driving; (2) lubricating oils that do not evaporate at high temperature; (3) wider application of the "streamlining" principle; (4) light metal alloy body construction; (5) control of traffic by super-sonic or radio signals in the car; (6) improved highways; (7) more easily cleaned upholstery and floor mats that will not warp, shrink or wrinkle; (8) quieter cars by means of increased noise control; (9) continued improvement in brakes to provide higher decelerations without harshness; (10) improved engines and reduced weight.

NOVA HERCULIS

NOVA HERCULIS, the newly discovered nova star, which has caused wide-spread interest within the past few months, is again increasing in brilliance, according to an announcement made by Leon Campbell, of the Harvard College Observatory.

Rallying after it reached its faintest magnitude, 13, early in May, the star has now reached the eighth magnitude, has undergone marked spectrum changes and has

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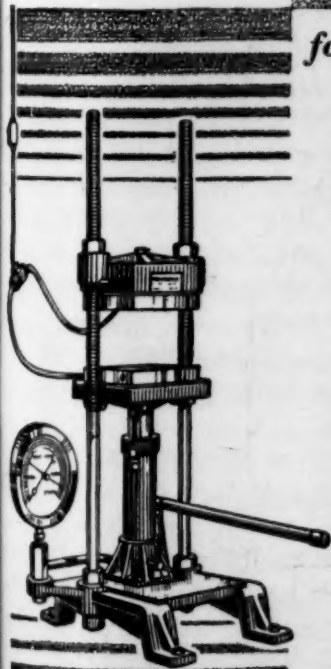
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definitely passed into what is usually termed the nebular stage. "It now looks as if the nova has passed through its stages of marked, and irregular, activity and that it will soon settle down to a point where it will slowly, but surely, decrease to the magnitude it was before its sudden outburst in December last. The return to normal may require several years."

The star was discovered on December 13, 1934, by the English meteor observer, J. M. P. Prentice, and at that time was of the third magnitude, having flashed up from the fourteenth magnitude, probably, within a very few days. From then until December 22 the light of the nova steadily increased, with slight fluctuations, and on December 22 the star reached the magnitude of 1.4 and was exceeded in brightness only by brilliant Vega.

Until April 1, the star was easily seen with the naked eye, varying between the second and fourth magnitudes, and then in two days it faded away at the rapid rate of about a magnitude and a half a day. After April 3 the decrease was more gradual, according to Mr. Campbell, until in early May it reached its faintest magnitude, 13, where it was seen only with the greatest difficulty with powerful telescopes. The star is now clearly visible in small telescopes at any time throughout the night, passing through the zenith about midnight.

"Practically all the changes in brightness have been accompanied by changes in spectrum," Mr. Campbell said. "During the early stages, the nova was of a distinctly bluish color, indicating that it was then an extremely hot star. When first photographed, the nova showed a spectrum containing strong absorption lines of hydrogen, with the lines of the metals bordered by intense emission lines. As the nova became brighter the emission lines faded away and the star had a spectrum closely resembling that of the supergiant star, Gamma Cygni. After maximum light was reached, the emission lines flashed forth with customary nova brilliance, this indicating that the nebulous shell surrounding the star had become partially transparent. Later, the well-known green auroral lines appeared as have been found in many other novae. Since the comeback in the star's light, marked spectrum changes have occurred. The nova has definitely passed into what is usually termed the nebular stage. The spectrum is outstanding in many ways, even among novae, and therefore difficult of interpretation at this time. How bright will Nova Herculis get? Judging by its prototype, Nova Aurigae 1891, probably it will not attain naked-eye visibility but it will be visible in moderate-sized telescopes."

At any rate, most of its activity is probably over and it will soon settle down to a point where it will slowly decrease to the magnitude it was before its sudden outburst last December.

LIGHTNING BOLTS

THE enormously high electric voltage which science has always associated with lightning bolts appears to be unnecessary. Lightning progresses through a series of step-like jumps, and each jump requires only a part of the millions of volts potentially necessary to jump from a high cloud to the ground.

Dr. B. F. J. Schonland, D. J. Malan and H. Collins

speaking before the Royal Society, London, gave experimental proof upsetting to science's previous conceptions of lightning's behavior.

Sir Charles V. Boys, the eighty-year-old inventor of the special high-speed camera which Dr. Schonland and his colleagues used in the new work, said that the discovery was "An amazing phenomenon which could never have been predicted."

It is found that when a multiple lightning flash occurs there comes first a slow-moving "stepped leader," which precedes the first flash. Compared with subsequent happenings in the lightning stroke, this preliminary "leader" is slow, lasting as long as a fiftieth of a second. It is possible to overlook this action when the Boys camera runs at its fastest speeds.

The leader starts as a small spurt of light covering from twenty to 200 yards at a jump. Its speed is the highest ever observed for a lightning flash—50,000 kilometers a second, or 31,068 miles an hour.

Then the streak disappears entirely for about one fifty-millionth of a second. Next a new dart-like streak starts at the point of cessation of the first streak and travels about as far as the first. Thus, the lightning "leader" reaches the ground in a series of from eighteen to twenty jumps.

With the atmospheric path thus cleared by the leaders, the first real flash occurs, which jumps upward from the ground to the cloud with a velocity of about 31,000 miles a second (one-sixth the velocity of light). This is the flash seen by the eye.

RESEARCH ON CANCER

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THE real "cure" of cancer is to be achieved by re-establishing the body's defenses against malignant growth, according to a prediction made by Drs. J. Maisin and Y. Pourbaix, of the Cancer Institute of the University of Louvain. The means of accomplishing this—suitable diet or possibly chemicals obtained from certain animal organs—are indicated by studies just reported in *The American Journal of Cancer*.

For the present cancer patients can not hope to be cured by diet. They must still rely on surgery, x-rays and radium. The work of the Belgian investigators is still in the experimental stage and their results, promising though they seem, have been obtained only with mice suffering from one form of cancer. The studies are now reported as a cure for cancer but as a signpost, pointing what seems to be a logical and promising way to an ultimate cure of cancer.

The report states that "The experimental results recorded may be interpreted as indicating that it is possible to influence the evolution of tar cancer in one direction or the other by diet. The results show unquestionably that chemical factors can be found which protect against cancer or lower the resistance to definite carcinogenic (cancer-producing) substances."

The scientists proceed in the cancer problem on the theory that it is a constitutional disease rather than a local ailment. Consequently they think treatment should be aimed at strengthening the body's defenses, rather

than at destroying the cancerous growth. Cancer in their opinion is the "peculiar response of injured cells" of an animal—mouse or man—that has been intoxicated by organic poisons. These poisons may be certain chemicals, as in tar cancers, or they may possibly be poisons produced by the "germs" of chronic infection, or they may be still other poisons that get into the body.

Rebuild the body's natural defenses and the body will be able itself to destroy and dispose of the cancer, they reason.

"By our experiments," they report, "we have demonstrated that in changing by diet the chemical composition of the organic fluids of an intoxicated animal it is fairly easy to modify its cancer response. It is reasonable to assume that by further studies it will be possible to find organic chemical compounds which, injected or given in the diet, will protect against the poisoning which leads to atypical growth and cancer. We believe, also that in this way it will be possible to make a cancer slowly disappear, by reestablishing the organic defenses which will take care of the growth. Such a cure of cancer seems more logical than a specific remedy with power to kill cancer cells and leave untouched normal cells."

ITEMS

THE new comet in the southern sky discovered by Dr. John Jackson, of the Royal Observatory, Cape of Good Hope, Africa, has been sighted by astronomers at Harvard College Observatory, Dr. Harlow Shapley reports. Dr. Fred L. Whipple and Dr. L. E. Cunningham, of the observatory staff, find that the brightness of the newest comet is diminishing. When first observed in the southern sky just a bit above the star Antares in the constellation of Scorpius, it was of the thirteenth order of magnitude. Now it has dwindled to the fifteenth order. The fainter a stellar object is, the greater is the number assigned to its order of magnitude. Even when first sighted, the Jackson comet was much too weak to be seen with the naked eye.

STILL increasing in brilliance, the planet Venus, which has been shining conspicuously in the western evening sky for several months, set longest after the sun on June 29. Now it will continue to brighten, but is drawing nearer to the sun's direction. On August 2, it will be at its greatest brilliance, nearly twice as bright as at present, but then it will rapidly become fainter. By the end of August it will have vanished from view as an evening star. Venus revolves around the sun once every 225 days, at a distance of 67,200,000 miles, instead of the 2,900,000 miles which separate sun and earth. Just now, a line from Venus to the sun, and one from Venus to earth, would be at right angles, so we see the planet farthest separated from the sun, at the position called "greatest eastern elongation." After this, as Venus comes closer to earth, it also comes more into line with the sun, and sets earlier.

A STRONG ocean bottom earthquake occurred June 24 near the French-owned island of New Caledonia, off the coast of eastern Australia. The epicenter is located at

23 degrees south latitude and 165 degrees east longitude and was calculated by the U. S. Coast and Geodetic Survey from telegraphic data collected by Science Service. This would place the shock center almost in the Tropic of Capricorn, about 800 miles directly east from the Australian coast, and about 900 miles northwest from the tip of New Zealand. The time of the shock was fixed at six hours and 22.2 minutes eastern standard time on June 24.

THE great lake of fire in Halemaumau Pit, in the Kilauea volcano, Honolulu, is expected to burst into eruption at any moment, according to Superintendent Edward G. Wingate, of Hawaii National Park. Volcanologists had predicted an eruption to occur at about the time of the spring equinox, based upon previous cycles of volcanic activity and current indications such as earth tremors. The expected eruption did not materialize as scheduled, but the great volcanic pit is showing continuous activity and the indications are that the lake of fire may be expected to return soon to the crater. The walls of Halemaumau are sliding daily, sometimes as separate rocks, sometimes in large masses. Meanwhile a solfatara, or small, geyserlike formation at the foot of the west wall, is pouring out blue fumes and is increasing in area and in brilliancy of color. The majority of the tremors recorded on the seismograph of the Volcano Observatory located on the rim of the crater are originating beneath or close to Kilauea. The last eruption began on September 6, 1934. It resulted in the lake of fire remaining in the firepit for over a month. An interesting feature of that activity was the issuance of burning lava from vents in the walls which resulted in fire falls of molten lava cascading down 500 feet of the crater walls.

A NEW operation for bunion in which the foot gets well quickly and the patient can wear ordinary shoes in comfort is reported by Dr. Earl D. McBride, of Oklahoma City. The operation proved satisfactory in thirty-nine consecutive cases. He called it a conservative procedure which tends to restore the normal architecture of the toe. The muscle that pulls the toe inwards is released by the operation. The muscle on the outside is shortened. Thickened tissues are removed and also a small amount of bone if the deformity is severe. The mechanical force causing the deformity is thus corrected. An additional advantage is having the scar underneath, where it is safe from irritation.

A COMBINATION of surgery with radium treatment is the most promising method of treating cancer of the middle ear, it appears from a report by Dr. Leroy A. Schall, of Boston. This kind of cancer was once considered a medical curiosity, but Dr. Schall finds it neither so rare nor so hopeless as formerly thought. Treatment with surgery, radium or x-ray alone is disappointing. Radium treatment following surgery was given to six patients. Four have survived for from two to four years. Of the two who died, one died of pneumonia two years after the treatment, but his cancer had not returned.

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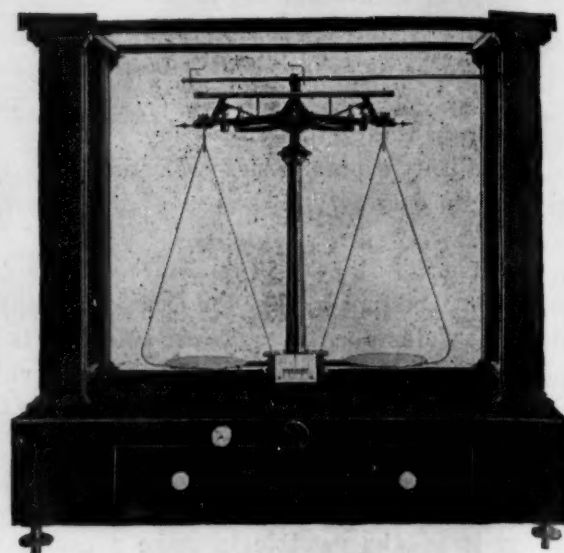
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SCIENCE NEWS

Science Service, Washington, D. C.

PROFESSOR EINSTEIN'S NEW THEORY

PROFESSOR Albert Einstein, from the Institute for Advanced Study at Princeton, N. J., has announced a new theory which should profoundly affect the whole structure of physical science. Continuing his world-recognized rôle as scientific "coordinator," Professor Einstein offers the first mathematical "signposts" which may point the way to a welding of his own famous relativity theory and the new quantum theory into a single, more powerful tool for science. Both relativity theory and quantum theory have been of such fundamental importance that the men who devised them have won the highest award in science—the Nobel prize.

Here are the outstanding, startling concepts in Professor Einstein's new and yet-unnamed theory: (1) Space is pictured as two sheets. (2) Particles in space are envisioned as "bridges" linking the two sheets. (3) The most elementary particle in nature is one without gravitating mass, *i.e.*, without weight. (4) Electricity and mass are not related but appear as independent constants in the equations.

In a report to *The Physical Review*, the official publication of the American Physical Society, Professor Einstein, with Dr. N. Rosen as collaborator, describes how his own general relativity theory accounts for the large-scale happenings of nature, but fails when attempting to explain the atomic structure of matter. At the same time, he adds, quantum theory, while highly successful in describing the interactions of atoms and their still smaller parts, fails to explain phenomena in the field of relativity. At present, depending on the job at hand, science chooses either one or the other theory as a "tool." In analogy science is now working like a carpenter who uses a saw to cut wood and a hammer to drive nails.

Professor Einstein, in trying to combine the two theories, would like to have science (as a carpenter) have one tool which both cuts wood and drives nails.

Sufficiently complex in its mathematical details to tax the ingenuity of the legendary twelve men who were originally said to understand Einstein, the new theory pictures space as represented by two sheets. The presence of an elementary particle without electrical charge in this space is represented as a "bridge" connecting the two sheets. With the help of this "sheet-space and bridge" picture, "one is able to understand the atomistic character of matter as well as the fact that there can be no particle of negative mass," Professor Einstein reports.

An important and unusual outcome of the new theory is that the "most natural electrical particle in the theory is one without gravitating mass," to use Professor Einstein's own words. A particle without gravitating mass would be one which weighs nothing. This state of zero mass is represented by one "bridge" between the two sheets of space. An electron or proton, according to the theory, would be a "two-bridge" problem.

Still another conclusion reached by the new theory is

that the mass of a particle like an electron is not related to its electric charge. The charge (e) and the mass (m) are independent constants of integration, to use the mathematician's term.

In his analysis of his own new theory, Professor Einstein gives as points in its favor: (1) It explains the atomistic character of matter; (2) it explains the circumstance that no neutral particles of negative mass exist; (3) it uses no other variables in the equations than those of the gravitational field and the electromagnetic field.

"On the other hand," Professor Einstein concludes, "one can not see *a priori* whether the theory contains the quantum phenomena. Nevertheless one should not exclude *a priori* the possibility that the theory may contain them." Which, in effect, means that while the new theory does not, at present, explain atomic happenings as does quantum theory, one should not jump at the conclusion that there is no possibility that it may do so.

The following is Professor Einstein's description of his new theory in his own words: "The writers investigate the possibility of an atomistic theory of matter and electricity which, while excluding singularities of the field, makes use of no other variables than the gravitational field variable of the general relativity theory and the electromagnetic field variable of the Maxwell theory. By the consideration of a simple example they are led to modify slightly the gravitational equations which then admit regular solutions for the static spherically symmetric case. These solutions involve the mathematical representation of physical space by a space of two identical sheets, a particle being represented by a 'bridge' connecting these sheets. One is able to understand why no neutral particles of negative mass are to be found. The combined system of gravitational and electromagnetic equations are treated similarly and lead to a similar interpretation. The most natural elementary charged particle is found to be one of zero mass. The many-particle system is expected to be represented by a regular solution of the field equations corresponding to a space of two identical sheets joined by many bridges. In this case, because of the absence of singularities, the field equations determine both the field and the motion of the particles. The many-particle problem, which would decide the value of the theory, has not yet been treated."

ECLIPSE OF THE MOON

FOR the first time since November 27, 1928, for people in most parts of the United States, a total eclipse of the moon will be visible during the night of Monday, July 15. Until 9:15 P. M., eastern standard time, the moon, full as always at the time of its eclipse, will be seen shining with its usual splendor. At that time it will start to enter the outer part of the earth's shadow, called the penumbra, but hardly any effect will be noted until nearly an hour later. During this time a person on the moon would see the dark disk of the earth partly covering the sun, but still so much sunlight reaches the moon that it

brilliance is hardly affected. At 10:12, however, the moon begins to enter the umbra, the dark inner shadow of the earth, whose circular outline can be seen on the lunar surface, as the sunlight begins to be cut from it completely.

After its first appearance on the eastern edge of the moon, the earth's shadow will creep across until completely covering it at 11:09. From that moment until 12:50 A. M. on the morning of the sixteenth, the moon will be in total eclipse. At 1:47 A. M. it will emerge completely from the umbra, and at 2:43 A. M. from the penumbra, bringing the eclipse to an end. It will be visible from all North and South America, Western Europe and Africa, and a large part of the Pacific Ocean.

Even at midnight, when the eclipse is at its middle, the moon will not completely vanish from sight, but will shine with a peculiar copper red color. This is due to the earth's atmosphere, which acts like a prism, and bends some of the sunlight around into the shadow, to illuminate the eclipsed moon. As sunlight passes through the air, some of its blue rays are extracted, producing our blue sky. With these rays gone, the light which passes through is predominantly red and is responsible for the eclipsed moon's color. A similar effect accounts for the red color of the setting sun, but then the light does not pass through as great a thickness of atmosphere as that which reaches the moon at eclipse time.

To the imaginary observer on the moon during its eclipse, the sun would be hidden by the earth's dark disk, but around it would appear a brilliant ring of red, due to this atmospheric refraction. At rare intervals, however, it might happen that a complete ring of opaque clouds would encircle the earth in the particular part of the atmosphere where the sun's light is passing through. Thus, there have been eclipses of the moon when it did go out of sight completely.

X-RAYS AND THE GROWTH OF TISSUES

X-RAYS' growth-stopping effects have been critically studied on healthy animal tissues that would ordinarily regenerate themselves, by Dr. Pressley Lee Crummy, working under direction of Dr. H. H. Collins at the University of Pittsburgh. These studies throw light on two regions of biological interest: they furnish a basis for comparison between x-ray effects on normal and abnormal growing tissues such as cancer, and they add information on the curious phenomenon of regeneration, by which certain of the lower animals are able to replace lost body-parts such as tails and legs.

Dr. Crummy experimented on the spotted newt, a long-bodied, long-tailed relative of the more familiar frogs and toads. Amputating the tail-tips of some of these animals, he x-rayed the cut ends of part of them with appropriate dosages of x-rays at various time-intervals. The others he left unrayed, as "controls." After some weeks he examined the lot.

The "control" animals were found to be going through the normal regenerative procedure, growing themselves new tails as they would after an accident in nature. The x-rayed newts, on the other hand, were still stump-tailed as the amputation had left them; they had averaged only

about a millimeter of new growth—about the thickness of an ordinary knifeblade.

A strange differential effect was observed. Dosages sufficient to inhibit regeneration completely when given immediately after operation would not stop regeneration when administered some weeks after regeneration was under way. The delayed dosage, however, was found to slow up the growth rate of the limb and to cause abnormalities in the formation of the fingers.

In preliminary experiments, Dr. Crummy tried x-raying the very tips of some of the newts' tails. Without exception, a degeneration and sloughing off of the tissues took place, reminiscent of the loss of finger-joints suffered by early workers with x-rays, before their destructive powers were known.

In the experiments, of course, due consideration was taken for the feelings of the newts. The operations were performed under anesthesia, and their bodies, except for the parts to be x-rayed, were protected during treatment under a quarter-inch lead shield. Apparently it doesn't bother a newt to lose a piece of leg or tail—perhaps a compensation of Nature for having them bitten off by hungry fish or snapping-turtles. At any rate, they seemed to be quite contented without them, while they grew replacements, and incidentally, furnished biologists with excellent material for fundamental studies of growth phenomena.

COASTAL EROSION

DISCUSSIONS which may lead to a truce in the relentless warfare between sea and land will be the order of the day when the American Shore and Beach Preservation Association, a body of engineers and public officials attempting to work out a science of coastal erosion, meets in convention at Ocean City, N. J., on July 11, 12 and 13.

The association was organized in 1926 to find solutions to the problems of thousands of owners of summer cottages along the Atlantic Coast, who often found their summer homes reduced to driftwood by winter gales which lashed the beaches. Houses were built in many cases too close to the high water line, in the mistaken idea that the most desirable seashore property was that which was within a stone's throw of the sea. Owners too often woke up to find the sea at their doorsteps.

Captain R. S. Patton, director of the U. S. Coast and Geodetic Survey and director of the association, is of the opinion that scientific research alone can provide a permanent answer to beach erosion problems. In a recently released paper, he stresses the fact that the present practice of building bulkhead or protective structures which minimize the effects of the waves can only slow down the erosion and can not effect a permanent solution to the problem. The alternative of an offshore breakwater parallel to the beach, which causes the waves to break where they can do no harm, he finds too expensive to be practical. What should be done, according to Captain Patton, is "to bring together a small, carefully selected group of men, trained in research," who will accumulate a foundation of reliable data, which is now entirely lacking. "If we find good men and assure them a free hand

in sympathetic support, we need not fear that they will not produce worthwhile results."

Governor Harold G. Hoffman of New Jersey, Brigadier-General George B. Pillsbury and Senators Harry Moore, W. Warren Barbour and George L. Radcliffe have signified their intention to attend the conference, according to J. Spencer Smith, president of the association and chairman of the New Jersey State Board of Commerce and Navigation.

THE TESTING OF THE DURABILITY OF CONCRETE

MORE than a century of the ravages of time and weather have been simulated in the thousand cycles of freezing and thawing of concrete specimens recently completed in the research laboratory of the Portland Cement Association at Chicago.

The reaction to severe winters is one of the measures of the durability of a structural material exposed to the weather. In the laboratory tests, specimens of concrete of various shapes and sizes go from tropical warmth to the middle of a hard winter and back again in a twenty-four hour period.

The specimens to be tested are immersed in water containers and placed in a freezing room where it is always 20 degrees below zero. Then they get a thawing in a tank where the water is kept at 80 degrees.

After twenty or thirty cycles, the specimens are dried and weighed to determine whether there has been any deterioration or spalling of the surface. The original weight of each specimen is carefully recorded and periodical weights are determined as long as the tests continue, which is sometimes for years.

This is only one of the phases of the research work constantly going on in the laboratories of the Portland Cement Association. Scientific data obtained through its research laboratories and by its fellowship men at the National Bureau of Standards are made available to engineers and contractors so that the quality of concrete may be constantly improved.

ITEMS

THE Mexican coast 250 miles west southwest of Mexico City was rocked by an earthquake at 1:49 A. M., on June 29. "Very clear" and "fairly strong" was the description of the shock reported by seismological stations throughout North America. The epicenter was located at 18 degrees north latitude and 103.3 degrees west longitude, according to calculations made by the U. S. Coast and Geodetic Survey from telegraphic data supplied by Science Service. This would make the shock center just a few miles off the coast where the Mexican continental shelf drops rapidly off into the depths of the Pacific Ocean.

FOR more than an hour, the bright star Antares will hide behind the moon on Friday evening, July 12, according to computations made at the Nautical Almanac Office of the U. S. Naval Observatory. The moon will be in a gibbous phase, half way between first quarter and full. At 8:22 P. M., Eastern Standard Time, astronomers in

Washington will see the star vanish suddenly as it is covered by the moon's dark edge. At 9:44 P. M., it will be uncovered, and the star will reappear from the moon's opposite, and bright, limb. In other parts of the country, the times will differ from these by a few minutes. Such occultations of a bright star are rare, and are observed by astronomers because they permit a very accurate check on the moon's motion. Antares is the bright red star in the constellation of the scorpion, in the southeastern evening sky.

DR. PURCELL G. SCHUBE, of the Boston State Hospital, has found that sodium rhodanate, contrary to claims advanced for it, is of no value in treating mental disease. His opinion, based on experience with 75 patients suffering from various mental disorders, is reported to the current issue of *The American Journal of Psychiatry*. The sodium rhodanate treatment was advocated by Professor W. B. Bancroft, of Cornell University, who suggested that mental disease can be explained by the dispersion of the brain colloids. Dr. Schube found, contrary to Professor Bancroft's views, that it is impossible to differentiate between two types of mental disease, dementia praecox and manic-depressive psychoses, by the contrasted use of sodium amytal and sodium rhodanate. He writes: "The ideas of Bancroft and his co-workers relative to mental disease and the methods of treating it did not prove to be of any value at all when the experimental method was applied to them."

THE unexplained disappearance of a deadly lethal factor from its hereditary make-up has made possible the appearance of an unusual new type of evening primrose among the experimental plants of Dr. George H. Shull, professor of genetics and botany at Princeton University. The new variety, which put in its appearance for the first time this spring, is characterized by leaves whose petioles or leaf-stems are longer than the blades of the leaves themselves. They form a marked contrast to the normal leaf, which is over ten times as long as its leaf-stem or petiole, and for this reason Dr. Shull has named the new variety *Oenothera petiolaris*.

A TWO-THOUSAND square mile blind spot, in southwestern Yukon Territory, a region of lofty mountain ranges and deep glacier-filled valleys and gorges, has been erased from the map of North America, according to Bradford Washburn, leader of the Yukon Expedition of the National Geographic Society, who has just returned to Washington to make his report to Dr. Gilbert Grosvenor, president of the society, after four months in the field. The crossing afoot for the first time of the St. Elias Range near the border of Alaska and the Yukon, was an outstanding feat that tested the stamina of the men. Several immense new mountain peaks were discovered while en route over this range and their positions located with surveying instruments. At one time, Mr. Washburn said, the expedition carried cameras and surveying instruments to a height of more than 12,000 feet on Mt. Hubbard and set up the highest survey station ever occupied in Canada or Alaska.

SCIENCE NEWS

Science Service, Washington, D. C.

THE REMOTE NEBULAE

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THE distant nebulae are closer together than the ones in our part of the universe, according to the latest measures of Dr. Edwin Hubble, of the Mount Wilson Observatory of the Carnegie Institution, who uses the world's largest telescope for his observations.

However, Dr. Hubble is not ready to accept the most obvious interpretation of his results. The measurements involve nebulae so far away that it takes several hundred million years for their light to reach us and various things have to be taken into consideration.

Dr. Hubble took the temperatures of the nebulae to be 6,000 degrees Centigrade and assumed that the farther a nebula is from us the redder its light appears. This so-called red shift has been observed for the nearer nebulae, but the more distant ones are so faint that they can not be examined even with the 100-inch telescope he used.

According to recent theories, the universe is best regarded as a uniform space constantly expanding, and Dr. Hubble's results raise a difficulty with the concept of uniform space. This difficulty has been examined theoretically by Professors R. C. Tolman and P. S. Epstein, of the California Institute of Technology. Working independently, they showed that even a homogeneous expanding universe could behave in accordance with the measurements of Dr. Hubble.

This is possible only if the matter in the universe is many times more dense than has been regarded as possible in the past. On the average there would have to be one atom in every quart of space. This would mean that 99.9 per cent. of the matter in the universe is non-luminous and that the stars and nebulae which we can see are only a minute fraction of the whole.

Astronomers raise the question as to how it is possible to hide such vast quantities of matter in space from all their observations.

When the 200-inch telescope is finished, the question will most likely be decided. Until then there are too many uncertainties involved to take any single theory too seriously. If the theory of Professor Tolman is correct, it would mean that we can see one quarter of all the nebulae in space with the 100-inch telescope and probably the 200-inch telescope will see out as far as there is any space.

ARTIFICIAL RADIOACTIVITY IN MEDICINE

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MEDICINE, including the treatment of cancer, and other sciences, may soon be able to benefit from useful quantities of many elements made artificially radioactive. The technique for producing such elements is rapidly developing, as is instanced by their production by a combination of neutron bombardment and paraffin bath, which acts like a neutron reflector and has raised the yield by 20 to 100 times. This statement is made by Professor Enrico Fermi, the Italian physicist, who discovered the

unknown element numbered 93. Dr. Fermi is taking part this summer in the symposium on physics at the University of Michigan.

About two thirds of the known elements can be made temporarily radioactive by bombardment with neutrons, which are particles of matter weighing the same as a hydrogen nucleus, but without any electrical charge. The neutron, however, must strike the nuclei of the atoms of the element being bombarded and be retained, to produce radioactivity. Because of the "vast" space, relatively speaking, between atoms, the great majority of the intended projectiles never find marks, with the result that infinitesimal amounts of the changed, radioactive elements are produced.

In the neutron reflector process used by Professor Fermi, the source of the neutron "bullets" is surrounded by a cylinder of the element to be bombarded, and the whole apparatus is surrounded with water or paraffin. The secret of the increased production of an activated element is found in the fact that both water and paraffin contain much hydrogen and that hydrogen nuclei and neutrons have the same weight. Neutrons which do not hit their intended targets shoot on beyond, into the water or paraffin. Here they are very likely to strike a hydrogen nucleus. Being without electrical attraction, the neutrons may then bounce back into the cylinder of the element being attacked and thus get a second chance at their mark, after the reflecting collision.

Not all of the neutrons get this repeat chance or chances, Professor Fermi points out, but enough do to raise the production of the activated element by 20 to 100 times. An added advantage of the method is the fact that after having bumped into a hydrogen nucleus the speed of the neutron is so slowed down that if it does bounce back and strike one of the desired atom targets it is more likely to be held.

Since the radioactivity of the artificially excited elements is essentially similar to that given by radium, but temporary in duration, medical men are watching developments with interest. There is definite possibility that in the future some cancers and other conditions may be treated by radioactive chemicals which will surround the diseased spot with a temporary field of curative activity and which can be closely controlled, both as to time and strength, by the physician. While some such treatment now seems likely, when radioactive elements are available in quantity and variety, a long period of experiment must precede practical application.

Uranium, of atomic number 92, is the heaviest radioactive element existing in nature, but it is unstable, slowly breaking down. By neutron bombardment, some uranium atoms can be transformed into new elements which lie beyond uranium and are therefore numbers 93 and 94. These are, however, extremely short lived. While there is a chance that some elements of even higher atomic number might be formed by bombardment, in Professor Fermi's opinion they are essentially so very unstable that

they could not possibly last for a reasonable time. This is the reason why such elements are not found under natural conditions.

DINITROPHENOL AND CATARACT

REPORTS of cataracts following use of the drug dinitrophenol as an anti-fat remedy in California focuses attention upon the dangers of using this method of reducing.

Only a few days ago the Council on Pharmacy and Chemistry of the American Medical Association refused to accept dinitrophenol and preparations containing it as a "new and non-official remedy," pointing out its dangers and urging that its use be restricted to selected patients under observation of properly trained physicians.

Repeatedly the official journal of the association has warned against wide-spread use of the drug and protested against sale of the drug except on physician's prescriptions. Now this drug can be obtained by any one at any corner drug store.

Moreover, about twenty commercial concerns are merchandising dinitrophenol or preparations in which it is an active principle. Some of these preparations are sold under trade names for reducing purposes, so that those who use them may be endangered by the drug without knowing of their danger. It is estimated that about 100,000 persons in America alone have used the drug for the treatment of obesity since its introduction for this purpose.

For the past fifty years investigators have studied the action of dinitrophenol and similar chemical compounds in accelerating metabolism, that is, the burning of tissues within the body. In 1933 its possible usefulness in treating obesity was shown by American studies, but its dangers were also soon shown by the experiences of some of those treated.

Useful in the making of dyes and explosives, dinitrophenol was known to be poisonous through its toxic effects on munitions and other industrial workers.

THE MANUFACTURE OF CARBOHYDRATES BY PLANTS

It's just a simple leaf inhaling carbon dioxide, but if it ever stops breathing in what man breathes out, all life as it exists to-day would cease in a short time.

Dr. Dean Burk, U. S. Department of Agriculture scientist, and Hans Lineweaver, working in the Bureau of Chemistry and Soils in Washington, report that they have come five steps nearer in understanding the baffling chemical processes by which the leaf manufactures carbohydrates. His report was given to the biological conference now in progress at Cold Spring Harbor.

It is now only a matter of time, Dr. Burk said, until several more leaf reactions will be discovered. Then, chemists believe, man will be able to adopt and even improve on the method used in the green leaf chemical factory.

The process is known as basic photosynthesis. Chemists have long known that the wood in trees is created by the leaf. Its green coloring matter, chlorophyll, acts as a catalyst helping the carbon dioxide of the air to

unite with water to form a primitive carbohydrate which, in turn, becomes cellulose.

Dr. Burk compared the reaction of photosynthesis to an endless chain-bucket pump in which the sun furnishes the power, the chlorophyll and another catalyst acting as buckets in pumping the carbon products to a higher energy level. The chemical equations he discovered are not of the simple type familiar to students of elementary chemistry, but depend upon changes of energy content.

The experiments were carried out with a green alga, *Chlorella*, in the life of which little happens except the change of carbon dioxide to protoplasmic carbohydrates. The importance of the work lies in the fact that when chemists can exactly duplicate the process, they will be able to improve and find short cuts. They may be able to do what Germany did in the war, her nitrogen supply having run low, due to blockades, when she reached into the air and "fixed" nitrogen, taking the plentiful gas and converting it into explosives. In the same way, chemists may eventually be able to create their own carbohydrates by taking carbon dioxide from the air or elsewhere.

It is also reported that those plants which are able to "fix" nitrogen do so by burning up the carbohydrates which their leaves created. It takes about as much energy to "fix" a pound of nitrogen as it does to "fix" a pound of carbon dioxide gas.

LACK OF SPECIMENS IN MUSEUMS OF NORTH AMERICAN ANIMALS NOW THREATENED WITH EXTINCTION

"EXPLORATION, like charity, begins at home." That is the pertinent comment of Dr. Roy Chapman Andrews, director of the American Museum of Natural History. Dr. Andrews, who has headed expeditions into the farthest corners of the earth in search of rare animals for museum groups, realizes that it's high time to hunt for specimens nearer home.

Recent droughts, dust-storms, floods and erosion, bringing many small rodents of the western prairies close to extinction, called attention to the fact that specimens of these and other native animals are entirely lacking in several cases. In the American Museum there is only one state—Connecticut—represented by a one hundred per cent. collection of its animal life. There are no collections whatever in the museum from the following states: Louisiana, Mississippi, Oklahoma, Alabama, Tennessee, Kentucky, Illinois, Ohio, Indiana, South Carolina, West Virginia, Pennsylvania, Maryland, Delaware and Rhode Island.

Sponsors of museum expeditions are usually interested in the fauna of far-away places, according to Dr. Harold E. Anthony, curator of mammals at the museum, in explanation of the situation. "We have now come to realize," he said, "that various forms of mammals in our country are in danger of extinction and have been going for some time. The great herds of antelope and bison which once roamed the plains have disappeared before the advance of civilization. Now the small burrowing rodents of the western states are being buried under drifts of dust, or drowned by floods."

Pre-historic horses and camels inhabiting the western part of America during fairly recent geological times suddenly became extinct for reasons not entirely understood, so that the horses brought over by the Spaniards under Cortes were the first that the Aztecs had ever seen.

Plans have been made for obtaining a complete collection from each state. Dr. Anthony hopes to secure a mobile laboratory with living quarters, to travel through various parts of the country, picking up specimens with the seasons. Meanwhile the museum is already extending its North American Mammal Collection with the aid of a number of persons who have opened their ranches in the West to staff-members of the museum. Several expeditions have already or soon will set out to collect deer, elk, bear and small animals.

PROPOSED APPROPRIATIONS FOR UNDERGROUND WATER RESOURCES

A SCIENTIFIC attack on the drought problem, by the U. S. Bureau of Mines, is provided for in a plan for exploring, measuring and charting the underground water resources of the nation, especially in the drought-stricken areas. Application for \$1,619,100 of Public Works funds has been made by the bureau for this purpose.

During the drought, wells disappeared, surface water was scarce, and definite knowledge was lacking as to where water was located deep underground. Underground water supplies are now greatly needed in many parts of the United States, bureau officials explain. A systematic survey of hidden water resources has been recommended by the National Resources Board.

Electrical methods of geophysical exploration, modern scientific successor of the discredited "water witch," will be used for finding water. When an electric current is passed through the ground, the resistance it encounters gives the observer a clue to what lies hidden beneath the surface, because different rocks and ores offer varying amounts of resistance to the passage of the current.

The prospector for water starts by placing his electrodes close together on the surface and then gradually increases their distance apart and thus increases the effective depth measured. If the ground at that depth contains a resistant body, such as oil, then the resistance recorded will be high. If it contains one which conducts electricity readily, such as copper ore, then the readings will be low.

Water, curiously enough, may have either low resistance or very high resistance, depending upon its chemical content. A person familiar with the geology and water character of the region can detect the presence and depth of water by this method. Preliminary work has already been done successfully in the Humboldt Valley of Nevada and in other localities by this method.

ITEMS

UNUSUAL atmospheric stagnation preventing the normal movement of heavy rain clouds accounted for the freak cloudburst and floods which swept over western and central New York State on July 8, leaving more than a score known dead and many missing in their wake. A high moisture content in the air, probably three times normal,

plus a severe local thunderstorm which failed to move onward in normal fashion, caused the catastrophe, according to Charles L. Mitchell, principal meteorologist of the U. S. Weather Bureau. Centering about Ithaca, which was the only government station to report unusual conditions, the heavy rainfall swelled creeks and rivers over their banks, and flooded the region. Had the storm clouds blown on, scattering rain over a larger area, the storm might have passed for nothing more than a local thundershower.

ABNORMALLY warm but good crop-growing weather characterized the past week in most parts of the nation, according to the U. S. Weather Bureau's weekly weather and crop summary. While a few localities particularly east and north of the Appalachians had abnormal rains, particularly New York State now struggling out of unusual floods, the south and interior valleys had much fair weather, with a high percentage of sunshine that was good for crops. Most states west of the Rockies could have used some of the excess rain of the east because vegetation west of the Rockies is feeling the effects of accumulated deficiencies of rainfall.

DISCOVERY of a new disease and progress already made toward its prevention are announced simultaneously by Dr. Charles Armstrong, of the U. S. Public Health Service, and Lieutenant-Commander Paul F. Dickens, of the Navy Medical Corps. The malady, which has appeared in isolated instances in a number of states, has features resembling meningitis, infantile paralysis and epidemic encephalitis, or sleeping sickness. The name "acute lymphocytic choriomeningitis" is suggested for it. The agent causing the disease is found to be a filterable virus. Cases have been reported in California, Maryland, District of Columbia, Illinois, Ohio and Virginia. It runs its course in ten days to two weeks, and recovery is complete without paralysis or other after-effects.

POTATOES have been stimulated into earlier sprouting and blossoming, and larger tuber yield at maturity, by treating the seed pieces with "supersonic" waves—sound waves of such high frequency that they are far beyond the range of audibility. The experiments were performed at the high-frequency laboratory of the State X-Ray Institute at Moscow. The waves were produced by an electrically excited quartz crystal, operating in an oil bath, at a frequency stated to be about 400 million cycles a second. The uppermost limit of audible sound waves is only about 20,000 cycles a second. Small numbers of potato tubers were exposed, in water, to these waves, and then planted after a short period in storage. The "sonized" plants sprouted and blossomed several days earlier than "control" specimens grown from untreated tubers, and their yield was increased by from 64 to 69 per cent. The experiments were performed under laboratory conditions only. Larger-scale tests under field conditions have not yet been undertaken. The first investigation of the biological effects of supersonic waves was carried on in the United States by Professor R. W. Wood, of the Johns Hopkins University, and A. L. Loomis, in the latter's private laboratory at Tuxedo Park, N. Y.



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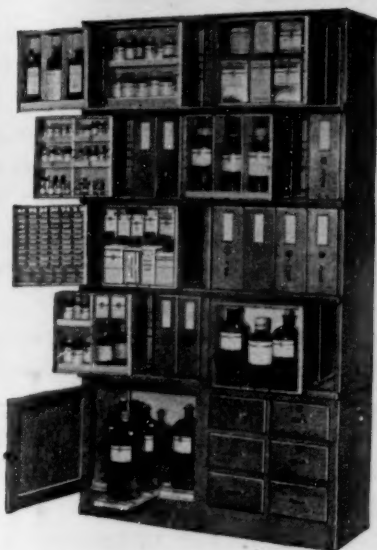
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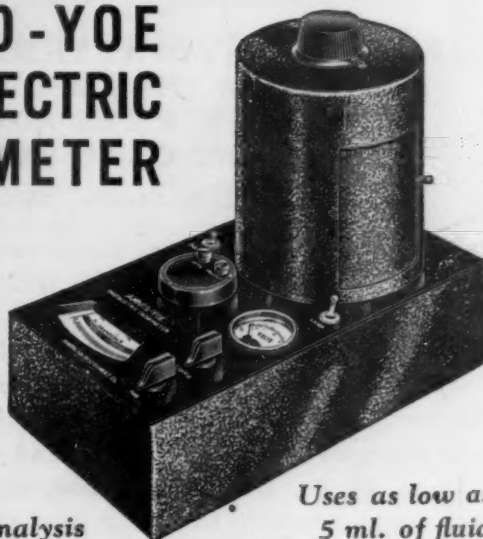
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SCIENCE NEWS

*Science Service, Washington, D. C.*PAPERS PRESENTED AT THE MINNEAPOLIS
MEETING OF THE AMERICAN ASSO-
CIATION FOR THE ADVANCE-
MENT OF SCIENCE

BY DR. FRANK THONE

SCIENTISTS who attended the summer meeting of the American Association for the Advancement of Science occupied themselves with the inspection of numerous exhibits which were arranged to show recent progress in a dozen fields of science, from anthropology to zoology. The center of interest in the medical exhibit was a demonstration of the causes and prevention of heart disease, by Dr. H. M. Nathanson, of Minneapolis. He has found a number of middle-aged people whose hearts he can stop at will, by pressure on a certain nerve in the center of the throat, and then start again by the administration of adrenalin and related drugs. Dr. Nathanson uses this procedure in critical tests of relative values of various heart medicines, as well as for the scientific study of the two principal causes of "heart failure," cardiac standstill and ventricular fibrillation. Another medical exhibit showed the usefulness of a preparation known as thorium dioxide sol in the more accurate x-ray diagnosis of cancers, tumors and other malignant conditions of the internal organs. This substance seems to have a tendency to concentrate in such tissues, so that they cast denser shadows on the photographic plates when x-rays are turned on the suspected body regions. An exhibit that attracted much interest was one bearing on the still-vexing riddle of ancient man in America, arranged by Professor A. E. Jenks, of the University of Minnesota. Outstanding in this display was the skeleton of a human being found in Minnesota, associated with stone dart points of the Yuma and Folsom types, closely resembling similar weapons that have been appearing in increasing numbers in apparently quite ancient deposits. Some of them, found in the southwest, have been mixed with the bones of extinct species of bison. Other flint points of the same type, not associated with human remains, have also been discovered in Minnesota. Even older than the "Brown's Valley" skeleton found with these dart points is a famous skeleton, known as "Minnesota Man," discovered by Professor Jenks some time ago. This was on display, together with the implements and ornaments associated with it.

AMERICA will soon be scraping the bottom of the barrel for some classes of indispensable mineral supplies, according to Dr. C. K. Leith, of the University of Wisconsin, and member of President Roosevelt's National Resources Board. Gold production in this country has long since passed its peak, he said. Measured reserves of oil, zinc and lead will last only about fifteen years at the present rate of use. Copper will be gone in forty years. There are centuries' worth of iron ore, but the reserves of really high-grade iron ore are good for only about four decades at the most. There is enough coal of all grades to last

4,000 years, but really good coal in readily accessible places will not feed our furnaces for more than two centuries. To remedy this situation as far as possible, slowing down exhaustion where it can not be finally avoided and thus at least staving off the evil day of mineral hunger, Dr. Leith recommended a program designed to leave the mineral resources to private enterprise, but at the same time to lend the authority of the Federal Government to support cooperative efforts toward ending the waste and other abuses. To implement this, he proposed some sort of a Federal Conservation Board, with flexible power within limits imposed by a general enabling act. He believed that a set-up of this kind is possible without a constitutional amendment.

SLEEPY seeds and how they are aroused formed the subject of a group discussion among the plant physiologists. The dormancy of seed wheat varies according to the degree of ripeness attained when the wheat is harvested, according to researches by Drs. A. H. Larson, John Larson and R. B. Harvey, of the University of Minnesota. Cereals go through their customary "rest period" quickly at high temperatures, but if kept near freezing they lie dormant for several weeks, although given all other conditions favorable for germination. At the same symposium Professor Charles A. Shull, of the University of Chicago, told of differences in the dormancy of very closely related plants. He worked with the seeds of rose mallows, which are all one species, but differentiated through cultivation into several horticultural varieties. He found that the seeds of the different varieties are as distinct in their hardness and resistance to germination as their respective flowers are in shape and color. Dr. E. D. McAlister, of the Smithsonian Institution, Washington, D. C., reported that some light rays cause seeds to stay "asleep," others tend to wake them up. The "sleep rays" most effective on lettuce seeds were of wave-lengths around 7,600 angstrom units, in the red part of the spectrum. The "arousers" centered around two wave-lengths, one at 7,000 angstroms in the red, the other at 5,200 angstroms in the yellow.

RECENT studies of the Brückner cycle, in which about 35 years elapse from drought to drought, show that the last great disastrous dry period in the West ended with the nineties, just 35 years ago. And the last great drought before that was in the sixties, another 35-year interval. The possible significance of the Brückner cycle was discussed at the meeting by Eric R. Miller, meteorologist in charge of the U. S. Weather Bureau station at Madison, Wis. The first person to mention a 35-year climatic cycle in print was Sir Francis Bacon, that versatile Elizabethan Englishman who was politician, essayist, lawyer and dilettante scientist. He referred to this phenomenon in his essay "On the Vicissitudes of Things." Three centuries later, a studious German, Eduard Brückner, made a really scientific study of the

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See the article "Colloidal Sulphur"—by Hiram E. Miller, M.D., Archives of Dermatology and Syphilology, Vol. 31, No. 4, pp. 516-525, April, 1935.

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AMERICAN COLLOID COMPANY, Chicago. *Bentonite: Technology and Industrial Uses*. A collection of bulletins bound together.

APPLETON-CENTURY COMPANY, D., New York, London. *Appleton-Century Medical and Surgical Books*, Pp. 66. Illustrated.

INSTRUMENTS PUBLISHING COMPANY, Pittsburgh. *The 1935 Instruments Index*. Pp. 29.

JUNK, W. The Hague, Holland. *Animalium Cavernarum Catalogus*. Pars 3: Pp. 33-224. Pars 4: Pp. 49-304.

LEITZ, INC., E. *Leitz Ultropak*. Pp. 32. 20 figures. *What Scientists Say of Leitz Ultropak*. Pp. 32. 30 figures.

MALLINCKRODT CHEMICAL WORKS, St. Louis, Chicago, New York, Philadelphia, Toronto, Montreal. *Analytical Reagents and Other Chemicals for Laboratory Use: 1935 Catalogue*. Pp. 112.

PUTNAM'S SONS, G. P., New York. *Fall Books, 1935, Including the Publications of Minton, Balch & Company*. Pp. 79.

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matter, taking into account such apparently unrelated things as lake levels, dates of the melting of river ice, vintage times, as well as the direct weather records. Brückner's investigations brought the data down to the middle of the nineteenth century. Mr. Miller has taken up the study where Brückner stopped, and carries the cycle study through to 1935, using principally data of American meteorological observatories. Although his results are not as clear-cut as he would like to see them, due largely to the short time covered by really reliable weather records in this country, they suffice at least as an indication of weather trends. So far as his data go, they show that droughts in the past have ended suddenly, with a sharp upturn toward cooler, rainier periods. The patterns shown by the low-rainfall curves of the sixties and the nineties have been followed closely so far this year, with a clean-cut upturn from the curve of the great drought of the thirties.

Was prehistoric man in America a hunter of mastodons and mammoths, as ancient European man was? This question, to which science as yet has no positive answer, is raised by a group of ivory objects collected in the upper Mississippi River Valley which were displayed before the meeting. Dr. A. E. Jenks, of the University of Minnesota, in charge of the exhibit, discussed the significance of the ivory objects. The collection is not large; two ornamented armbands, much broken; a three-cornered scraper with sawlike teeth on one side accurately carved in imitation of bear's teeth, and a tubular pipe, shaped like half of an enormously thick cigar, constitute the whole of it. Part of the objects were found buried below ground level, under an Indian mound that had nothing in it. They are all made of genuine elephant ivory. The workmanship is clean-cut and symmetrical, and the ornamentation, though simple, is competently applied. But whether the long-dead hunters slew the beasts and carved their ivory fresh, or whether they merely found it, or dug it up as fossil ivory, as men still do in Alaska and Siberia, there is at present no way of knowing. Lloyd A. Wilford reported that another tribe of old-time Indians in Minnesota once practised a unique form of cannibalism. A University of Minnesota expedition discovered a number of burials consisting of broken bones and empty skulls, their condition suggesting that the bones had been cracked to extract the marrow and the skulls cut open to extract the brains. The flesh was presumably eaten, but the bone marrow and the brains were probably used in the tanning of skins or for other industrial purposes. The scraps of skeletons were then gathered in bundles for burial.

DRS. THEODORE L. SQUIER and Frederick W. Madison, of Milwaukee, Wis., addressing a medical audience at the meeting of the association, stated that a very serious blood disease, in which white blood corpuscles are destroyed to a dangerously low number, is physiologically related to hay fever, asthma and other allergic troubles. This malady, known to physicians as granulocytopenia, has come into increased prominence recently, with the

wide-spread use of pain-allaying drugs based on amidopyrine. It has been commonly thought that the drug caused the disease simply by poisoning the systems of its ill-advised users. However, Dr. Squier pointed out that considering the large number of users, many of whom take massive doses without being affected, a different type of action must be considered as a cause. Further, patients who have recovered from attacks of granulocytopenia sometimes become seriously ill again from extremely minute doses, which is exactly the way in which hay fever or asthma is brought on in persons "sensitized" to such things as pollens, feathers or hair. Medical use of music, in carefully prescribed "doses," has become a useful therapeutic measure in public welfare institutions, according to a report by Dr. Clara E. Liepmann, of the Russell Sage Foundation, New York City. Ancient and primitive peoples have made medical use of music, but with a difference. Their systems were based mainly on magic; modern medical music makes use of the researches of psychologists.

As with animals, so with plants. Professor O. S. Aamodt, of the University of Wisconsin, called attention to the difference between yellow corn and yellow corn as sources of the important vitamin A. This vitamin seems to be connected with the yellowness of the grain; but not all yellow corn varieties are of the same value in this respect. There are three hereditary "Y" factors that produce it. Strains of corn possessing all three have correspondingly high vitamin value; strains with only one or two are not so good. But mere possession of the right kind of hereditary factors or genes is not enough to make one of the living pieces of producing farm machinery efficient. Environment has a lot to say about the expression of inherited excellences. The most highly drought-resistant wheat, for example, may not have a chance to "show its stuff" in non-drought years; and frost-resistant plants need frost to develop their superiority to their tenderer vegetable cousins. Professor Aamodt described a "drought machine" of his designing, which enables him to test resistant grain varieties without having to wait for a bad farm year to try them out in the field. The speakers stressed one great element of difficulty in "designing" most efficient farm animals and plants and "constructing" them by means of breeding procedures. The desirable qualities may be known, and the breeder may know how to combine them for the best possible results. But these good qualities may be so inseparably linked to less desirable qualities as to defy all efforts to choose the good and reject the ill. Thus, a pig with just the right firmness of meat may have the wrong shape for profitable marketability, or a drought-resistant variety of wheat may not mill into very good flour.

BETTER meat, but at less cost, is one of the objectives of modern scientific animal breeding, Dean W. C. Coffey, of the University of Minnesota College of Agriculture, explained before the meeting of the association. This objective is to be obtained by selecting for breeding purposes lines of animals that not only look handsome and

cut up well on the butcher's block, but in addition have highly efficient digestive and assimilative systems and are therefore able to form more meat out of a given quantity of feed than ordinary, unselected animals can. Some breeding stocks now at the university farm at St. Paul have had this "nutritional efficiency" so well developed that the best of them can make twenty-five per cent. more meat out of a given weight of feed than the least efficient feeders are able to show "in pay for their keep." In selecting a sire for the flock the breeder or farmer must look for high average in offspring, rather than a few fancy animals that will take blue ribbons, while all the brothers and sisters are little better than scrubs.

MANKIND'S ills can often be combated best not by direct treatment of patients but by studies of the way insects, worms, plants and other apparently unconnected organisms live in a disease-ridden region. The importance of such studies was stressed by Dr. Richard P. Strong, professor of tropical medicine at Harvard University Medical School, in the course of the Maiben Lecture in Medicine, which he delivered before the meeting of the American Association. Ever since the discovery of the rôle of mosquitoes in transmitting malaria, oil, swamp drainage and other sanitary measures have been more important than quinine in getting rid of that disease. Dr. Strong pointed out the marked correlation between prevalence and deadliness of malaria in some parts of the South, and the neglect of anti-mosquito work in those communities, due either to indifference or lack of funds. Other insect-borne diseases that are best reached through their insect carriers include yellow fever, typhus fever and African sleeping sickness. Sometimes the cycle of transmission is more complex, including some other animal besides man in the list of hosts to the disease-causing germ or parasite. Such, for example, are bubonic plague, where the carrier insect is a flea that bites rats and men indiscriminately, and tularemia, where rabbits are the alternative hosts. Again, the environmental or ecological influences take effect on man himself, making him susceptible to diseases under certain conditions, while at other times or in other places he may be immune. Or the factors may operate on the causal organism, making it virulent under some conditions and harmless under others.

IRON, one of the oldest medicines in the world, is still one of the most dependable for certain types of anemia, according to Dr. Walter A. Bloedorn, of the George Washington Medical School. Prescriptions as far back as 1600 B. C. required the use of iron, he said, and it has been used in hundreds of formulae since. Bland's pills, first used over a century ago, are still a standard remedy for certain types of anemia. The human body is not at all efficient for absorbing and using iron, so that relatively enormous doses have to be given to give the patient the needed benefits. However, there is apparently no danger in the use of iron; it seems to be impossible to administer an overdose. Also discussing anemia in its various phases was Dr. William P. Murphy, of the Peter Bent Brigham Hospital, Boston, Mass. Dr. Murphy described the new concentrated liver extract so potent that one cubic centi-

meter, prepared from an ordinary-sized slice of liver, has the anemia-preventing power of eleven pounds of fresh liver eaten in the ordinary way.

FACTORY-LIKE efficiency is required of farms nowadays. Their productive "machines" are living cows and pigs, cornstalks and wheat plants. These offer problems in biological engineering that differ from those which chemical engineering must solve for industry only in being much more difficult and complicated. When a set up of these living productive machines fails to deliver goods up to specifications, it must be discarded, just as iron machines in factories must be scrapped when they fail. Newer and more profitable models must replace the discarded ones. These analogies of urban industry found on modern farms developed at the meeting in the discussion of genetic problems as applied to agriculture. A specific example of exacting market specifications which biological engineering must modify its "machines" to meet was presented by Professor J. L. Lush, of Iowa State College, Ames. He cited the Englishman's demand for having his breakfast bacon "just so"; the strips of a certain length, as wide at one end as at the other, and with a proper proportion between the streak's o' lean and the streaks o' fat. Hog raisers who want their share of the profitable British bacon market have had to go in for breeding extra-long pigs, so as to produce the maximum number of slices. They have also had to breed for less fat on the back and more underneath, to keep the strips of even width from end to end, and to maintain that almost mystical ratio between fatness and leanness.

WHOOPIING-COUGH danger can be greatly reduced if babies are inoculated when they are about eight months old with a vaccine made from the germ held responsible for the disease, known to medical science as *Bacillus pertussis*. Tested now on many hundreds of babies, it has proved successful in totally preventing the disease in 90 per cent. of all cases where the vaccinated child was exposed by contact with another who was suffering from whooping cough. This recent advance in the battle against one of the most troublesome, and frequently fatal, among children's diseases was described by Dr. Louis Sauer, of the Northwestern University Medical School. The vaccine was first prepared several years ago, and at the outset used very cautiously in a limited number of cases. But when it proved to produce no ill effects and to confer immunity in an overwhelming majority of cases, more confidence seemed justified and larger numbers of vaccinations were made.

WHEN your head grows longer, it does not grow wider. That is, a difference in size usually means also a difference in relative proportions, or shape. This generalization is called "anatomic lag" by its originator, Professor Wilson D. Wallis, of the University of Minnesota. It holds good not only for heads but for hands, feet and other body parts as well, and he considers it probable that the same principle will be found to extend to all portions of the animal kingdom. Indications that this may be true have already been found in the measurement ratios of some of the lowest of animal forms, one-celled creatures visible only through a compound microscope.

The Science Press Printing Company

An article entitled "The Journal *Science* and the American Association for the Advancement of Science," printed in the issue of the journal for October 8, 1926, contains the following paragraphs:

In this connection acknowledgement should be made to the printers, The New Era Printing Company of Lancaster, Pa., and especially to Mr. Andrew Hershey. In 1893 they were printers of a local newspaper and of local job work. They offered terms much lower than any city printers and maintained the same rates for *SCIENCE* for twenty-five years. They proved themselves to be excellent printers and in 1920 were printing some fifty scientific journals. After one partner had died and the other two had advanced in years, the business was sold to a promoter, not himself interested in printing. Charges were greatly increased and the printing became less efficient.

Efforts were made to purchase the printing plant with cooperative ownership by the scientific journals that it printed, but these failed, partly because the \$300,000 asked included at least \$100,000 for the good will in large measure given to the business by *SCIENCE*, and partly owing to the difficulties of ownership by the societies and institutions that controlled the journals. When the Carnegie Institution was established in 1902, the editor of *SCIENCE* proposed the organization by it of an office for scientific printing and engraving which could have been made self-supporting, and, as in the case of the Oxford and Cambridge presses, would have rendered valuable service by assured continuity and expertness in scientific printing; but the plan was not adopted.

SCIENCE and the other journals of The Science Press were for a time printed in Utica, N. Y. In 1923 The Science Press Printing Company was incorporated with its office at Lancaster and with the cooperation of Mr. A. E. Urban as general manager and of those compositors, pressmen and proofreaders who had given that city distinction as a center for scientific printing. This company is now responsible for printing *SCIENCE* and a considerable number of other scientific journals, monographs and books.

As stated in this quotation The Science Press Printing Company was established to print *SCIENCE* and the other publications of The Science Press, including *The Scientific Monthly*, *The American Naturalist*, *School and Society*, and the Biographical Directories of "American Men of Science" and "Leaders in Education." The composition and press work of these publications show the high standards that are maintained. In order to bring them out efficiently and promptly—for example, the entire contents of an issue of *SCIENCE* can be put in type in one day and each week during 1933 about 14,000 copies of *SCIENCE* were printed, bound and mailed in a little more than one day—it has been necessary to have a shop of considerable capacity and to take in other work. The press now prints some thirty scientific and educational journals and series, and has printed many books and monographs.

It may be regarded as a real contribution to science that there should be a plant in which the workers are trained to deal with scientific material. Innumerable commendations of the accuracy of the proofs have been received; to quote only one, the late Professor E. S. Morse wrote to the editor of *SCIENCE*: "I corrected my first proof a year before you were born and the one I returned yesterday was the first one in my long experience that needed no correction."

It is also an advantage for scientific men to have relations with a company that maintains the same rates for the same kind of work under the same conditions. High pressure selling and competitive bidding—among the causes of the present economic depression which the codes promoted by President Roosevelt are intended to abolish—are thus unnecessary. A scientific man may assume that work entrusted to the press will be done at a cost as low as is consistent with high standards of work and the best conditions of employment for the workers. This is less than the cost of equally good work in large cities where wages and rents are much higher, but it is not so low as for inferior printing or where the welfare of workers is disregarded.

While the press must use efforts to obtain work when the capacity of the shop requires it, its object has been to make it as great an advantage for the scientific man to have work done by it as it is for it to do the work. This policy has succeeded, for employees have not on the average been idle as much as one day a year since the press was established; no regular employee has been laid off even during the present economic depression; wages were decreased by 10 per cent. for

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THE ENERGY OF GAMMA RAYS

MAN-CREATED gamma radiation, of the kind so widely used in the treatment of cancer, and excelling the best efforts of nature over six times, is being studied at California Institute of Technology. Four investigators, headed by Professor C. C. Lauritsen, of the Kellogg Radiation Laboratory, report in *The Physical Review* that they have unmistakable evidence of laboratory-produced gamma rays having energies of 16,000,000 electron volts. The highest energy found in natural gamma rays—given off by radioactive substances such as radium—is only 2,600,000 electron volts; an energy "record" held by the radioactive element known as thorium C" (thorium C double prime).

Professor Lauritsen's 16,000,000 electron volt gamma rays were obtained in experiments performed in collaboration with Dr. H. R. Crane, Dr. L. A. Delsasso and W. A. Fowler. The light metal element lithium was bombarded with protons, the positively-charged nuclei of hydrogen atoms, to yield the piercing rays.

The proton atomic "bullets" were driven down a special vacuum tube in the research by electric voltages which ranged from 400,000 to a million volts. On striking the lithium target, the proton is believed to combine momentarily with lithium atoms. The lithium atoms are thought to be the isotopic form of mass seven. When a proton joins them, it adds its mass of one so that the total mass is eight.

The 16,000,000 electron volt gamma rays which emanate from the union are best explained by assuming that the lithium and proton of total mass eight break up into two helium particles, each of mass four. Such helium nuclei are known as alpha particles and, along with gamma rays and electrons, are given off when radium disintegrates. To balance the energy equation, it is necessary to postulate that 17,000,000 electron volt gamma rays come out when the two alpha particles are created. The presence of 16,000,000 electron volt rays was detected quite definitely by a study of the atomic "débris" knocked out. Tracks of the flying electrons from the impacted atoms of the lithium target were observed in a Wilson cloud chamber in the investigation of the high energy gamma radiation.

"FORBIDDEN LIGHT"

"FORBIDDEN LIGHT," which in reality never reaches the earth, has been indirectly analyzed by the spectroscope to give man increased knowledge of his remotest neighbors of the universe, the far distant nebulae. Dr. I. S. Bowen, of the California Institute of Technology, announced this achievement in spectroscopy at the Massachusetts Institute of Technology conference at Cambridge.

Applying a recently developed astronomical theory, he has investigated the light which does reach the earth and has worked back to an analysis of the "forbidden" wave-lengths of light. This light, with its plentiful energy, is situated in the extreme ultra-violet of the spectrum and

it is believed to cause the light that reaches the earth. Theoretically the forbidden light, present in the powerful energy of the extremely hot stars, excites the tiny atoms of helium and hydrogen in the star. As these shaken-up atoms return to normal, they emit the light that reaches the earth. This phenomenon is known as "the fluorescence of hydrogen and helium in the stars."

For some time astronomers have been seeking to learn more about these astronomical islands whose distance in space is measured in terms of millions of light years with the penetrating eye of the spectroscope to aid them. It has been possible to analyze some of the light coming from these nebulae and much has been learned concerning their composition, probable origin and condition.

The fact that all the light leaving the nebulae does not reach the earth, some of it being filtered out by the layer of ozone circling our globe, has been a great obstacle to more complete knowledge. Attempts to produce this light artificially in the laboratory have also failed, and the light has been termed "forbidden" since science has never been able to analyze it.

RAYS OF SUNSHINE THAT DO NOT REACH EARTH

THE first comprehensive studies of just what part of the sunshine has beneficial effects on man and animals were reported to the third International Conference on Spectroscopy held at Massachusetts Institute of Technology.

Dr. John M. W. Bunker and Dr. Robert S. Harris, both of the Massachusetts Institute of Technology, gave white rats specific doses of rickets and then exposed them to definite wave-lengths of light to determine just what rays would hasten the bone calcification, the failure of which causes rickets. It was found that the wave-lengths between 2537 Angstrom units and 3025 were the sources of beneficial vitamin D.

An unusual aspect of the find was that nearly all of the valuable therapeutic light is artificial in that it never appears in sunshine, for these rays are stopped by the earth's atmosphere. Dr. Bunker explained this paradox by saying: "It happens that animals of strictly nocturnal habits subject to rickets can be cured of this disease by light, and especially by light of wave-lengths which in nature never reach the earth."

The very fact, it was suggested, that the rats respond to light which is filtered out by the layer of ozone surrounding the earth now, may mean that at some previous time the sun emitted shorter, much more penetrating rays which ploughed through this ozone layer. This suggestion that the sunlight which our prehistoric ancestors enjoyed in the prehistoric days may have been different from that observed to-day is, of course, purely hypothetical, but is a feasible explanation.

THE QUANTUM THEORY

FOLLOWING Professor Albert Einstein's criticism of the quantum theory on the grounds that it does not give

a complete description of physical reality, Professor Niels Bohr, of the Institute of Theoretical Physics at Copenhagen, makes reply. He is one of the leading exponents of the quantum theory, for certain developments of which he was largely responsible. The theory was initiated by Professor Max Planck; others associated with it are those of De Broglie, Dirac, Eddington, Heisenberg, Jeans and Schroedinger.

Professor Bohr's initial rejoinder is in the form of a letter to the editor of *Nature*. He is shortly to publish a longer communication in *The Physical Review*, where the paper by Professor Einstein, Dr. Boris Podolsky and Dr. N. Rosen was published. His criticism of the deductions of Einstein and his co-authors is based on disagreement with their criterion, or standard of test, of physical reality. He does not think that their definition of this reality can be approximately applied to problems of quantum mechanics.

Professor Bohr writes: "Since, as the authors show, it is always possible in quantum theory, just as in classical theory, to predict the value of any variable involved in the description of a mechanical system from measurements performed on other systems, which have only temporarily been in interaction with the system under investigation; and since in contrast to classical mechanics it is never possible in quantum mechanics to assign definite values to both of two conjugate variables, the authors conclude from their criterion that quantum mechanical description of physical reality is incomplete. I should like to point out, however, that the named criterion contains an essential ambiguity when it is applied to problems of quantum mechanics."

THE "ELECTRIC EYE" AND THE RECORDING OF EARTHQUAKES

A NEW way of making earthquakes write reports of their occurrence in distant parts of the world has been devised by Halley Wolfe, of the California Institute of Technology. It combines the advantages of two former systems, and avoids disadvantages that handicap both of them.

Present types of earthquake records are made in two ways. In one, an instrument with a heavy pendulum holds a delicate pen-point against a sheet of moving smoked paper, and makes wiggly lines when an earthquake occurs. The advantages of this method are its low cost and its constant visibility; its disadvantage lies in the lower sensitivity caused by the heavy weight.

In the other method, a small mirror, mounted on a much lighter, more delicately balanced weight, causes a beam of light to dance back and forth on a sheet of photographic paper when the quake comes. This method has the disadvantages of requiring the use of expensive photographic paper. Furthermore, the only way in which the observer can tell whether a quake has occurred is to remove and develop the recording sheet.

In Mr. Wolfe's new device, the mirror-directed beam of light is used, but the photographic paper is omitted. Instead, the beam plays on a photoelectric cell—the "electric eye" of physicists—which sets up a fluctuating current as the beam flickers across it. This electric cur-

rent, suitably amplified through a vacuum tube hook-up, drives a specially constructed pen which records the waves on a moving sheet of plain white paper.

Mr. Wolfe's apparatus, set up at the seismological laboratory of the Carnegie Institution at Pasadena, has been in successful operation for over a year. Records made by it in ink on paper correspond in exact detail with records of the same earthquakes made by the direct photographic method.

BEETLES ON THE NEW JERSEY COAST

STORMS probably were responsible for the deluge of Japanese beetles recently cast up by the sea along the New Jersey coast making beaches of summer resorts unfit for bathing or lounging in the sand. Apparently drowned by immersion in the Atlantic, beetles by the thousands came to life and transformed sunny expanses of sand into stretches teeming with squirming insect life, to the disgust of vacationists.

The so-called "heavy flight" season for these insect pests is at its peak at present, and New Jersey, where they first appeared in America, has greater numbers of them than any other state. Although they seldom fly more than 200 to 300 yards, a heavy wind blowing offshore could easily have blown tens of thousands into the Atlantic to be cast up again by the waves. Their extreme hardiness would keep great numbers alive even after considerable time in the water.

Soil about the roots of a shipment of Japanese iris to New Jersey concealed grubs of the Japanese beetle and was accidentally responsible for their introduction into the United States, where entomologists discovered them in 1916. Since then they have spread with great rapidity and have established themselves as the undisputed princes of plant destroyers.

Peach, apple, pear and shade trees are some choice feeding grounds preferred by these insects, although they will devour with relish dozens of vegetables and other varieties of trees. The smooth green fairways of golf courses are much in demand as good locations for the hatching of grubs.

Entomologists have found these beetles to be wily as well as hardy, and consequently extremely hard to poison with ordinary "bug dopes."

Every conceivable way to rid America of Japanese beetles has been tried. Trees have been sprayed with extracts of plants known to be repellent to the insect. Parasitic wasps and flies have been introduced from China, Japan and India. At one time breeding of a species of bantam rooster known to feed upon them was considered. Elaborate traps using the scent of geranium as a bait have been developed. All these succeeded in checking the spread of the pests somewhat, but not in destroying them.

THE SOVIET STRATOSPHERE FLIGHT

RIPPED balloon fabric ended the recent (June 26) Soviet stratosphere flight just as it caused the failure of the Army Air Corps-National Geographic Society balloon *Explorer II* before it left the ground. Whereas no lives were seriously endangered by the latest American adven-

ture, the Russian flight in the *U. S. S. R.* balloon ended without major tragedy only because two of the three men who made the ascent jumped in parachutes and lightened the load at the crucial instant.

Details of the Soviet venture have just reached Science Service in mailed dispatches from Moscow. They offer a picture of what might well have happened to the *Explorer II* if its accident had occurred in the stratosphere instead of on the ground. Professor Alexander Verigo, chief physicist of the Department of Radioactivity and Cosmic Rays of the Geophysical Laboratory in Leningrad—who was scientific observer—and engineer Y. Prilutski, the co-pilot, were the two men who jumped. Chief pilot K. I. Zillie, was then able to bring the balloon to a safe landing without damaging its scientific apparatus and cosmic ray records.

At 45,000 feet altitude on the ascent the balloon passed through a layer of turbulent air which tossed the 24,000 cubic meter bag to and fro. It is believed that this stormy session caused the rips. The buoyant gas quickly leaked away and only the parachute jumps stayed the rapid descent to a degree that made a safe landing possible.

ITEMS

THE probability of war between Italy and Ethiopia has resulted in the newest link in the world-wide system of radiotelegraph communication to handle the expected increase in message traffic. Cable and Wireless, Ltd., of London, announces that London and Addis Ababa, Ethiopian capital, are now in direct communication by radio. The previous circuit included a relay station in Cairo, Egypt. Messages from the United States are transmitted from New York to London by RCA Communications and then to Ethiopia by its British associate, Wireless and Cable, Ltd.

THE recent moon eclipse improved radio receiving conditions according to the preliminary results of tests made by Dr. Harlan T. Stetson and T. S. McCaleb, of the Institute of Geographical Exploration of Harvard University. Tests for nights after the eclipse are expected to give support to Dr. Stetson's theory that the moonlight affects radio signal intensity. "It was a novel sensation to observe an astronomical event through clouds by radio methods," Dr. Stetson said. In spite of clouds that obscured the moon visually the observations of radio signals from Station WBBM Chicago were successful, showing improved conditions as the moon entered the earth's shadow.

THE spectroscope, instrument that analyzes the light of stars, chemicals and other industrially useful things, promises to tell why some skins sunburn with rashes and splotches and others just redden and tan. To the Massachusetts Institute of Technology conference on spectroscopy Dr. Harold F. Blum, of the University of California, explained the use of the spectroscope to study various kinds of sensitivity of human skin to light. Normal skin is sensitive only to that light which ordinarily produces sunburn and then tanning, he said, but some skins possess

special pigments which respond to light with various rashes and splotching. By sorting sunlight with a spectroscope he was able to filter it and determine the exact wave-lengths which caused particular rashes. This may suggest possible cures although no progress in this direction has been made as yet.

MARKED progress toward the complete and positive identification of pepsin, the important digestive juice found in the stomach, which is expected to be of tremendous aid to medicine, was reported to the third International Conference on Spectroscopy, meeting at Massachusetts Institute of Technology, by Dr. George I. Lavin, of the Rockefeller Institute for Medical Research. Although science has for years realized the importance and the function of pepsin and has been fairly sure that it was composed of carbon, hydrogen, oxygen and other elements, just what amount of these substances constitute pepsin and how they are chemically arranged has remained a mystery. Only recently it was discovered that pepsin is a protein, but medicine has looked in vain for much-needed additional information. Dr. Lavin's research, conducted with the spectroscope suggests that pepsin may have some amino-acids in it. His method was to compare the spectra of pepsin with those of substances of which it might be composed.

EXCEPTIONAL progress toward a solution of the problem of the structure of hemoglobin was reported by Dr. David L. Drabkin, of the University of Pennsylvania, who spoke at the Conference on Spectroscopy. Hemoglobin is that complex constituent of the blood which acts as a conveyor of oxygen to the various parts of the body. Its importance, Dr. Drabkin said, is exceeded only by the difficulty of studying it. With the spectroscope, however, Dr. Drabkin has been able to conduct analyses far in advance of any carried on previously and although the problem is still unsolved, steps toward the ultimate solution have been made. Dr. Drabkin described the comparative ease with which spectroscopy had enabled investigators to study vitamin B₁, the oldest known yet most elusive vitamin. The next step, he said, would be a method of studying the reflection spectra of tissues directly to replace the present method of studying biological substances in solution.

THE amount of lactic acid in the fluid in the spinal cord gives aid in diagnosing certain diseases of the brain and central nervous system, particularly meningitis, Dr. S. Bernard Wortis, of New York City, reported at the second International Neurological Congress meeting in London. The measure of this acid may also be used to tell the physician something of the progress of the disease and the patient's chances for recovery. Children may be protected against infantile paralysis by two small hypodermic injections of the killed virus of the disease obtained from the spinal cords of monkeys. The work leading to this method of protecting children against infantile paralysis was carried on by Dr. Wortis and Dr. Maurice Brodie, both of New York University.

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SCIENCE NEWS

Science Service, Washington, D. C.

MECHANISM IN BRAIN WHICH SETS OFF CONVULSIONS

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MEDICINE has discovered the part of the brain believed to cause convulsions like those occurring in epilepsy. The convulsion-causing brain center acts like a "trigger" which, when stimulated, sets off a neurological "explosion" throughout the whole brain. Drs. F. A. and E. L. Gibbs, of the Harvard Medical School, described before the meeting of the International Neurological Congress in London experiments leading to the discovery of the brain trigger.

The trigger is a short fiber system running between the frontal cortex basal ganglion and the thalamus. Parallel research on brain tumors of cats and in man indicate that the same part of the brain is responsible for convulsions in each. Studies on four hundred cats in which the trigger mechanism was stimulated by means of an electrode inserted through a small hole in the skull served to determine finally the location of the convulsion-causing brain fibers.

It is not believed that the trigger is a pathological mechanism. Dr. Gibbs believes it is present in all brains, normal or otherwise, but that in epilepsy the mechanism is disordered. The position of the mechanism, the scientist said, is now located as well as are the brain fibers controlling the dilation of the eye's pupil.

The Harvard experiments provide strong evidence that former ideas about the cause of convulsions were wrong. It had been suggested that convulsions came about because of stimulation of the blood vessels or of certain other parts of the brain. The new discovery may change the diagnosis of epileptic convulsions. Dr. Gibbs explained that physicians formerly sought a diseased condition responsible for epilepsy, but that as a result of his research they will now have to seek a disorder in the neurological mechanism which he believes is present normally as a safety valve in the brain.

EXPERIMENTAL HEADACHES

SEVERE headaches and pulsations of the brain fluid were linked at the congress by the American physicians Drs. Dean Clarke, Heloise Hough and H. G. Wolff, of Cornell University Medical School, New York City. When a headache is most severe the brain fluid pulsations are the largest, according to experiments in which subjects were given temporary laboratory headaches.

The chemical known as histamine was injected into the veins to bring on these experimental headaches. Histamine is created by the body tissues, especially those of the lungs and the gastro-intestinal tract. Brain fluid pulsations were measured by inserting a hollow needle into the spinal cord and connecting it to an instrument known as a Frank capsule. Pulsation changes within the brain, pulsations in the arteries and the blood pressure were all recorded automatically and simultaneously on photographic film for permanent record.

When histamine was injected the physicians found the arterial pressure increased and the cerebrospinal fluid pressure diminished, while at the same time the intracranial pulsations increased and the headache became more severe.

In experimentally produced headache, pain is associated with dilatation and distortion of the intracranial vessels. The sites of origin of the nervous impulses experienced as pain are probably the walls of the intracranial blood vessels and the perivascular tissues. This is further evidence that deformation of the intracranial blood vessels is an important factor in the production of headache as manifested clinically.

VEGETABLE FATS FOUND NUTRITIOUS

VEGETABLE fats are completely digestible and they satisfactorily fulfil the needs of the body for fat, according to Dr. Harry Steenbock, of the University of Wisconsin, who is known for his studies on vitamins.

Dr. Steenbock and his associates at the Wisconsin Experiment Station have confirmed the finding made at other experiment stations that lack of fat in the diet of experimental animals results in abnormal symptoms, including the stopping of growth. They found that white rats suffering from want of fat could be completely cured in from five to seven weeks by feeding them daily five drops of corn oil, 15 drops of lard, or 20 drops of a widely known vegetable fat purchased at a local grocery store.

The Wisconsin investigators found that all edible fats, animal or vegetable, are completely absorbed by the body if they will melt below body temperature. Hydrogenation of vegetable fats does not make them indigestible, therefore, unless it is carried so far as to give them a melting point of 100 degrees Fahrenheit or more. And this is not done with ordinary commercial vegetable fat.

Some fats are digested much more rapidly than others. It has not been proved, however, that quick digestion is desirable, although it is popularly associated with "easy" digestion. Slowly digested foods have a certain value in that they tend to keep one from growing hungry before the next meal.

"We found that cod-liver oil, halibut-liver oil, and butter oil were digested more rapidly than any of the other fats we tested," said Dr. Steenbock. "About 70 per cent. was absorbed in four hours. Of butter itself 60 per cent. was digested in the same length of time. Most of the other fats used for human food, such as lard, corn oil, soybean oil and cottonseed oil, were 50 to 60 per cent. absorbed in four hours."

It was found that certain compounds tend to slow up the digestion of fats, when consumed along with them. Sodium benzoate, a food preservative, reduced the amount absorbed in four hours from 54 per cent. to 14. Alcohol also markedly reduced the rate, and even cane sugar had some effect. Water made no difference.

Lack of vitamins in the diet, and abnormal body con-

ditions such as anemia also slowed down the rate at which fats could be digested.

RUBBER PLATES MAY BRING ABOUT NEW TECHNIQUE IN PRINTING

A PROCESS for printing from rubber plates has been developed at Akron, by the B. F. Goodrich Company, which may alter traditional methods of printing. Printing from rubber type is not new. Every one is familiar with the "rubber stamp," which has long been used to stamp out short notices or designs. Until recently, however, rubber as a substitute for metal in jobs requiring thousands of copies was thought to be impractical.

The new "elastotypes," or rubber plates, overcome many of the former objections to rubber as a printing material, and have several advantages over ordinary metal in certain types of work. They are particularly well adapted to printing on fragile or brittle materials such as tissue paper, Cellophane, celluloid, wood, metal, fiber and glass, which might be injured by metal type. Bond and other hard-surfaced papers print better from rubber because it conforms to the irregularities of the paper and is less affected by pressure change. Tests indicate that because rubber spreads a thinner film of ink than metal the saving of ink runs as high as 30-40 per cent. For the same reason, printing from rubber dries more quickly.

On the other hand, rubber swells when oil inks are used, and certain special inks are required to reduce the swelling to a minimum. As yet, halftones, except very coarse screen, can not be printed successfully in long press runs.

It is in the field of book printing that rubber plates offer the greatest promise for the present. Books have never been printed from the speedy rotary presses such as large newspapers have. They are usually run off on flat bed presses. Because rubber plates can be curved without distorting the type faces, they may make book printing on rotary presses practical. Scribner's Press recently printed the first book from rubber plates in the United States, "The Emerald Murder Trap."

SITE FOR THE NEXT STRATOSPHERE ASCENT

SCOTT FIELD, the former site of the Army Air Corps training school for balloonists near Belleville, Ill., may be the scene of the next stratosphere flight of the National Geographic Society-Army Air Corps.

If it is decided to attempt another hop to the upper regions of the earth's atmosphere late this fall in the balloon *Explorer II*, Scott Field would be admirably suited to the take-off.

Its central location would make it more easily possible to reorganize the stratosphere expedition than at distant Rapid City, S. D. Moreover, facilities for handling balloon flight plus a highly trained ground personnel are additional advantages.

Captain Randolph P. Williams, third Army Air Corps officer in the recent ill-fated disaster of the *Explorer II*, has just been at Scott Field studying the flying records

for the last five years from the field to determine what chance there is of obtaining good flying weather in September and October. Preliminary surveys indicate that October is a favorable month. Further checks against the records of the U. S. Weather Bureau for the region are now being made.

While the definite decision to hold another stratosphere ascension this fall has not been made, and will not be made until the cause of the rip in the balloon fabric in the recent accident has been determined, Scott Field offers one of the best locations, equipment and personnel if the affirmative decision is reached. It is one of two places in the country where the Army maintains troops trained in handling lighter-than-air craft. The other is Langley Field, Va. Scott Field is the lighter-than-air depot for the nation and handles all supplies and equipment. It was formerly the headquarters of the balloon school of the Army which has been inactive for a number of years. Its staff consists of 16 officers and 375 enlisted men.

Stationed at Scott Field is the twenty-first airship group; the ninth airship squadron; the twenty-first photographic section trained in aerial photography, and the fifteenth observation squadron.

NEW WIRELESS STATIONS IN AFGHANISTAN

THE most powerful of five new wireless stations for communication within Afghanistan and with the capitals of the world will be erected at Kabul shortly. The other four will be situated in important positions throughout the country.

Outfitted with a short-wave transmitter suitable for telegraphy and telephony, and two receivers, the Kabul station will reach all the capitals of Western Europe with ease. Regular communication with New York, Shanghai, Tokyo and Moscow will be established, as well as with Rio de Janeiro, Cape Town and Melbourne.

A central telegraph office for control of the wireless stations will be set up ten miles from Kabul, where the transmitting and receiving sites will be located. The latter will be separated, for more efficient operation, and equipment to reduce atmospheric interference will be used in the receiving station.

The Kabul transmitter will operate on 5,000 to 6,000 watts of power, and will have a wave range of 15 to 18 meters. A variable frequency oscillator with a frequency stability of 1 in 20,000 will be used; not a particularly high or constant stability, according to American engineers.

In contrast, the other four transmitters will use general short-wave long-distance quartz crystal controlled transmitters. These have very high frequency stability, but are inferior in other ways to the Kabul transmitter.

For communication with New York, Shanghai, Moscow and Tokyo, as well as the Western European capitals, directional or fixed aerials will be used. On the other hand, an omni-directional aerial or one movable in any direction will be used for communicating with Rio de Janeiro, Cape Town and Melbourne.

LABORATORY ON PIKE'S PEAK OF THE CALIFORNIA INSTITUTE OF TECHNOLOGY

THE laboratory of Dr. Carl Anderson, of the California Institute of Technology, in which he discovered one of the fundamental units of matter, the positive electron, is now on wheels on its way to the top of Pike's Peak, Colorado, which has an elevation of 14,000 feet.

The giant electro-magnet, the expansion cloud chamber in which the debris of atoms smashed by cosmic rays are photographed and a 50,000-watt generator for energizing the magnet, are all mounted on a truck and trailer now plodding toward Colorado. The outfit is a complete laboratory and power plant for the cosmic ray studies to be undertaken.

Working with Dr. Anderson in the Pike's Peak research will be Dr. Seth Neddemeyer, also of the California Institute of Technology. They will investigate how cosmic rays at high altitudes decrease as they come down through the earth's atmosphere. The high altitude rays differ markedly from those much rarer ones which come all the way through the air surrounding the earth to reach sea level or even below.

It will take until August 17 to reach the top of Pike's Peak and set up the equipment. Then there will be about a month before the snow begins and the work must cease.

However, because of the much greater intensity of cosmic rays at the altitude of Pike's Peak tip, more experimental measurements can be taken in the month than can be obtained in a year in Dr. Anderson's Pasadena laboratory. That's why Mohammed is going to the mountain, as the saying goes.

If everything goes well Anderson and Neddemeyer hope to take 10,000 photographs in their cloud chamber apparatus and most of these will show cosmic rays.

No one knows just what to expect from the experiments. A research program of this type has never before been undertaken.

ITEMS

A CURIOUS and still-unexplained relation between hay fever and the common cold which may provide a new method of attack on the latter disease is announced in the *New York State Journal of Medicine*. Dr. Louis Sternberg, of Beth Israel Hospital of New York City, has completed a six-year study of the subject and arrives at the following conclusion: Sufferers from hay fever in the summer are more susceptible than other people to common colds in winter, but when hay fever victims are treated with pollen extract for the affliction they show a greater immunity to colds later on. "The reason," states Dr. Sternberg, "for this apparent immunity to the infection known as the common cold is not now known."

SHORT radio waves can now be used in medical treatment of selected regions of the body, by a technique developed by Dr. Franz Nagelschmidt, of St. Bartholomew's Hospital in London. Dr. Nagelschmidt interposes a cylinder of wax and ebonite between the radio generator and the patient, localizing the heating

effects of the radiations, which have wave-lengths of from three to twenty meters. Use of short-wave radio in medicine is no new thing; it has been successfully employed for several years in the treatment of certain diseases requiring a rise in temperature. Hitherto, however, the whole patient has been put into a state of "artificial fever." Dr. Nagelschmidt's advance consists in finding a method for localizing their effect.

A PLEA that other peoples, especially those more primitive than ourselves, should not be judged and condemned on the basis of our kind of mental tests is made by Dr. Florence L. Goodenough, of the University of Minnesota. Mental tests of civilized white men may tell whether the individual tested is able to compete successfully under American conditions, but Dr. Goodenough urged that psychologists and anthropologists, if they desire to compare civilized and primitive man, should test sight, smell, running ability, manual dexterity, ability to learn and other such traits.

MAKE a loud enough noise at milk and the baby will digest it more easily. That, in effect, is the discovery reported by Dr. Leslie A. Chambers, of the University of Pennsylvania, who spoke before the American Dairy Science Association, meeting jointly with the American Association for the Advancement of Science. The apparatus used in the experiments consisted of a heavy steel diaphragm, driven by an oscillating electric current. Similar devices are used for submarine signalling. Over the diaphragm Dr. Chambers flowed a thin stream of milk, while he caused it to vibrate very strongly at various rates. The lowest vibration rate he used was 360 cycles a second, which is the pitch of F-sharp in the middle of the piano keyboard. The highest rate was 3,000 cycles a second, about three octaves higher than middle F-sharp. The effect was to alter the curd-forming character of the milk. Whereas the milk used normally formed a hard curd, difficult to digest, when acted upon by the pepsin of the stomach, after treatment it formed a soft, easily digested curd. Soft-curded milk is especially desirable for feeding babies, as well as older persons with "weak stomachs." Some cows naturally produce soft-curded milk, but many do not.

THE old saying about fleas having lesser fleas ad infinitum has had a recent confirmation in the researches of Theodore T. Ayres, botanical investigator at Harvard University. Dealing with a rare, mold-like fungus which had hitherto been seen but four times, Mr. Ayres discovered that it was parasitic and that it chose as victims only fungi of the same general kind as itself. When he tested it against a long list of fungi distantly related to it in the system of fungus classification, it was unable to attack them. It showed no preference as to the sex of its victims, but parasitized male and female strains with equal avidity. A remarkable alteration in the susceptibility of its hosts was found to take place, however, when they were grown on different nutrient materials.

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SCIENCE NEWS

*Science Service, Washington, D. C.*ALUM SOLUTION SPRAYED IN NOSTRILS
INCREASES ABILITY OF MONKEYS TO
SURVIVE INFANTILE PARALYSIS

THAT the use of nasal spray containing a weak solution of alum has been found to increase markedly the ability to survive infantile paralysis is indicated by experiments with monkeys reported by Drs. Charles Armstrong and W. T. Harrison, of the National Institute of Health in Washington, D. C.

Seventy-four per cent. of the monkeys treated with the solution survived injections of infantile paralysis virus. Only 16 per cent. of the untreated control animals survived the same injections. This is a survival ratio of four to one. "In addition to their higher survival rate the alum-prepared animals which developed poliomyelitis (infantile paralysis) tended to develop the disease later and the ailment ran a much slower course than was the case for the control groups."

The average interval from the first virus inoculation to complete paralysis for the alum-prepared group and the control group, respectively, was fourteen and two thirds days and nine and four fifths days. All alum-treated monkeys which became paralyzed recovered completely except one. The three sole survivors of the control group were completely paralyzed after the disease had run its course.

Cautiously, Drs. Armstrong and Harrison are not yet ready to recommend the simple treatment for human beings. They say: "The results here reported are not recommended for human use, but offer a hopeful avenue of approach which may lead to effective methods against poliomyelitis and possibly against other diseases contracted by way of the nasal mucous membranes." They have tried the alum treatment on themselves and find it produces a temporary tickling and stinging which causes an occasional sneeze. There is an increased nasal secretion for about an hour and then a feeling of dryness which disappeared after several hours.

How the alum solution helps to protect against infantile paralysis is not exactly known. Tests undertaken to show whether specific immunity was developed in the animals by the alum treatment indicate that no obvious increase in immunity was apparent. "The protective action of the alum solution is believed," Drs. Armstrong and Harrison conclude, "to be due to an alteration which decreases the permeability of the mucous membrane of the nose rather than to an antiseptic action."

THE EFFECTS OF RADIUM ON CELLS

THE effects of radium on living cells are always in the direction of breakdown and death; its powerful radiations, principally of alpha particles, never act to stimulate more rapid growth. These are the conclusions reached by Professor Frederick B. Flinn, of the College of Physicians and Surgeons of Columbia University, as the result of experiments on tissue cultures from living embryo

chick hearts, checked up with other animal cells and with one species of primitive one-celled plants.

Professor Flinn's interest was aroused by the tragic fate of a number of women workers on radium-illuminated watch faces, who suffered breakdown of their bones, particularly of their jaws, from the effects of radium unwittingly taken into their systems. In his researches, he used chick heart tissues, cultured in the way developed many years ago by Dr. Alexis Carrel, of the Rockefeller Institute for Medical Research. Each culture was divided into two halves, one of which was treated with radium in various degrees of intensity, while the other part was kept untreated as a check or "control." The type of tissue chosen was that most nearly resembling the fibroid or cancerous growths that have replaced healthy bone in the patients.

In no case was it found that a radioactive solution, even the weakest, was stimulative of extra growth. Any concentration of radium strong enough to have any effect at all had a slowing-down effect, and above a certain minimum strength they eventually killed the tissues exposed to them.

Dr. Flinn was therefore brought to the conclusion that the replacement of radium-destroyed bone by malignant fibroid tissue was due first to the destruction of the bone-repairing cells, which permitted the decay of the bone and its subsequent failure to re-form even when extra calcium is medicinally administered, followed by the abnormal tissue growth, and frequently by bacterial infection, as the result of the constant irritation which is known to occur at sites of fracture and of greatest bone stress.

MULTIPLE LIGHTNING STROKES

DESTRUCTIVE lightning strokes which shatter a tree or telephone pole, burst a block of concrete through which a wire runs or dig a hole in the ground are the result of too much confinement, according to a report made by P. L. Bellaschi, engineer of laboratories of the Westinghouse Electric and Manufacturing Co., at Sharon, Pa. If the core of the lightning stroke is confined within a bore having a diameter less than about eight tenths of an inch, internal pressures may be built up of anywhere between ten to twenty thousand pounds to the square inch. Few natural materials will stand such forces and naturally blow up.

Mr. Bellaschi will report in a paper to be delivered at the forthcoming meeting of the American Institute of Electrical Engineers in Seattle, Wash., that electrical engineers were led to investigate the shattering of wires by lightning strokes because of the paradox that small wires were known to be able to withstand high currents comparable with those of lightning and yet were sometimes fused and destroyed by lightning. The secret appears to be that many lightning strokes are not single discharges, but multiple ones. Lightning, in other words, sometimes strikes anywhere from five to ten times in the same place within a fraction of a second.

From a collection of experimental data gathered in a study of lightning with a super-speed camera it was found that 80 per cent. of the lightning strokes were single ones. The other 20 per cent. were of a multiple nature. The multiple flashes are suspected of being the ones which crush large hollow cylinders, fuse telephone wires and other heavy-current carrying electrical leads.

Laboratory tests showed that very heavy lightning strokes, having currents up to 200,000 amperes, would be needed to destroy conducting equipment in the manner authentically reported. The cumulative effect of several more moderate strokes coming one on top of the other is believed to explain the lightning paradox.

THE LARGEST SODIUM LIGHTING SYSTEM

THE largest installation of sodium vapor lighting in the world will be installed on the new San Francisco-Oakland Bay Bridge. More than 35 full moons would have to shine simultaneously to give the same average intensity of light on the upper roadways of the bridge, which will be reserved for passenger high-speed vehicles. The General Electric engineers who designed them claim that the golden yellow light of the sodium units has the greatest optical efficiency of any lighting system in existence. Small objects can be seen at low intensities with greater ease under the soft, diffused light of the sodium lamps than under any other kind, tests indicate, and at the same time they are far more economical than ordinary lights.

The 10,000 lumen lamps used on the upper level of the bridge will produce approximately two-and-a-half times as much light as ordinary lights of the same energy consumption. On the lower deck the 6,000 lumen units which will be installed to light the way for trucks and slower traffic will produce twice as much light as that obtained from incandescent bulbs of the same energy consumption. Lamps adding up to 6,720,000 lumens will be installed on the upper deck, and 1,500,000 lumens on the lower deck, making a grand total of 8,200,000 lumens for the entire bridge, the largest single order ever placed for sodium lights.

The new golden sodium lamps giving out 10,000 lumens require an energy in-put of only 220 watts, of which 185 watts or less goes to the lamp, the rest being used by transformers and other equipment. In comparison, ordinary incandescent lamps would require approximately 550 watts to produce 10,000 lumens. Consisting of a special sodium-resistant glass, the bulb of the 10,000 lumen sodium lamp contains a small quantity of sodium and some neon gas. When the lamp is cold, the first application of the current causes the neon gas in the lamp to glow brilliantly with its characteristic red color. Thirty minutes is needed to store up enough heat to vaporize the sodium fully and cause the lamp to shed its characteristic orange-yellow light.

THE BENDING OF THE EARTH'S CRUST DUE TO BOULDER DAM CONSTRUCTION

MAN at last has a chance to determine if the earth's crust—from 17 to 75 miles thick—will bend under a great

weight. Theory says it will, but until the construction of Boulder Dam no way seemed possible to prove the answer.

The U. S. Coast and Geodetic Survey is planning to make accurate surveys of the region around Boulder Dam to see if the weight of the dam and the huge lake it will store up are sufficient to compress the underlying rock of the great continental shields. The estimated weight of the lake alone is placed at 41,500,000,000 tons. Never before has man placed such an enormous weight on one spot of the earth's crust.

Theory says the solid layers on the outside of the earth really float on a much heavier material which lies below in a plastic state. The condition is much like a woven raft of logs afloat on a lake. If a heavy weight is placed on such a raft it submerges partially. It is thought that the weight of mountains similarly submerges the bottom of the solid crust into the underlying plastic material.

Behind the plans of the Coast and Geodetic Survey is the thought that an additional-increase in weight at one spot will further sink the floating crust until equilibrium is established. Engineers expect that the elastic compression of the rock in the earth's crust will cause an area of twelve square miles to sink six tenths of a foot in from two to three years.

The sinking of the solid crust into the plastic matter beneath may cause an additional two foot drop over an area of 150 square miles. How long this lowering will need to occur is not known. Eventually, however, bench marks soon to be established well tell the story.

GIANT TURTLE AND MOSASAUR FOUND IN ALABAMA

GIANTS that were deadly enemies in the warm seas of the world 70,000,000 years or so ago have been found as fossil skeletons in the rocks of Alabama by Dr. Walter B. Jones, state geologist and director of the Alabama Museum of Natural History.

They were a tremendous sea turtle, whose bones still bear the marks of an enemy's teeth, and a mosasaur. Mosasaurs were kin-beasts of the great dinosaurs that ruled the land, and they were themselves no less the tyrants of the sea. They were huge, short-necked, paddle-limbed reptiles, with powerful jaws like crocodiles and long, snaky, flat-tailed bodies built for speed and maneuverability in the water. The tooth-marks on the turtle's bones were doubtless inflicted by a mosasaur, which either caught and slew the turtle or found and devoured its body after death in some other manner.

Discovery of the fossil remains of these two sea giants in what has long been solid land in Alabama shows how far the sea transgressed the Gulf slopes of America during the Cretaceous, or Great Chalk Age, when they were living. The wide central valley of this continent has been invaded by the sea many times during the long ages of geology, and the records of these millions of years of ebb and flow are written in the sedimentary rocks. Both skeletons were in a more or less broken-up condition when found, but the pieces have been carefully cleaned and fitted together, and are now on display at the museum.

MOCKINGBIRDS FIGHT TO DEFEND THEIR TERRITORIES

MOCKINGBIRDS, like most songbirds, recognize definite property rights, and will fight vigorously to defend them. Mockingbird landholding customs have been carefully studied by Harold Michener and Josephine R. Michener, of Pasadena, who present a detailed report in the current issue of *Condor*, journal devoted to observations and researches on birds of the West.

When a male mockingbird in spring finds a suitable place for bringing up a family, he posts himself at a prominent point and by loud singing notifies all comers that he has staked his claim. Would-be claim-jumpers of his own sex are promptly attacked and routed. When he is joined by a female and takes her for his mate, the territory he has chosen becomes the source of the family food supply for that breeding season. The male continues to defend it, the female taking no part in his fights in defense of the home territory, but devoting herself to her maternal affairs.

But after the young ones are raised and the nest abandoned, both birds select a winter feeding territory, which often includes the nesting area, but usually has wider boundaries. This they defend together, the lady being no less pugnacious than her mate if an intruder tries to forage in it. Boundaries, once established, are usually recognized by the birds on both sides of them; though some individuals are less careful about respecting their neighbor's property rights than are others, and have to be chased home frequently.

ITEMS

DROUGHT is edging into the national weather picture again, despite the heavy drenching the soil got over the whole country during the spring. U. S. Weather Bureau reports indicate the beginnings of a serious lack of moisture in wide areas in the grain-growing sections. "Much of the Midwest experienced another unfavorable week through a continuation of abnormal heat and scanty precipitation," according to *The Weekly Weather and Crop Bulletin*. "Some areas received timely and beneficial rains, but over the greater portion of the country, between the Mississippi River and the Rocky Mountains, moisture is badly needed, as rainfall for many weeks has been scanty."

THE earthquake that caused destruction and death in the Colombian city of Pasto and in neighboring towns, on the morning of August 7, had its center almost on the equator, near the Colombia-Ecuador boundary, U. S. Coast and Geodetic Survey seismologists announced after examining data transmitted through Science Service by a number of observatories. The location of the epicenter was given provisionally as one degree north latitude, 78 degrees west longitude. Time of origin was 4:02 A. M., Eastern Standard Time.

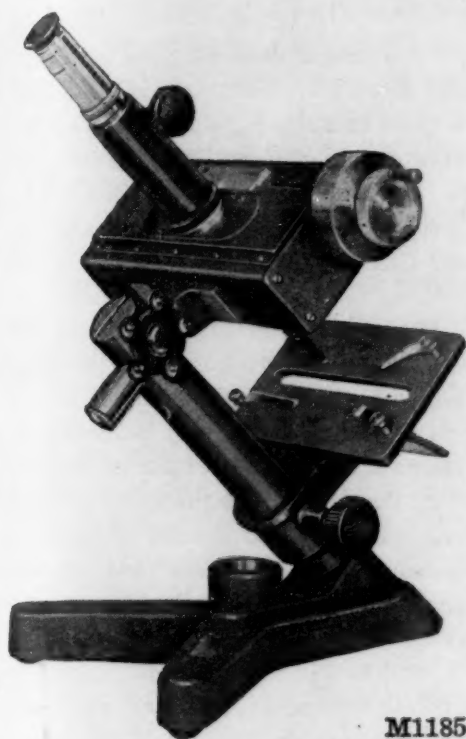
VENUS, the brilliant "evening star" that has been shining in the west just after sunset during the spring and early summer, will soon be gone from the evening sky, but another planet, Saturn, is appearing in the east to

take its place. In the meantime, Jupiter still shines brilliantly, though inferior to Venus, in the southwest, and to its right is Mars, identified by its red color. On September 8, Venus will be in the same direction as the sun, and now, as it rapidly draws into that position, it is setting sooner and sooner after sunset. By the end of August it will be gone before the sky is dark enough to show it. By the end of September, however, it will move to the western side of the sun and then, rising before sunrise, will be a brilliant "morning star."

A METHOD of taking portrait-pictures by x-ray, pictures which show the fleshy part of the face as well as the bones underneath, has been developed by Dr. W. Teschendorf, roentgenologist of Cologne. X-rays have the power to pass through the flesh of the body but are stopped by the bones, which consequently appear as shadows in an ordinary x-ray picture. When a physician wants to see other, non-bony parts of the body, such as the digestive tract, he gives the patient a drink containing a substance that will stop the x-rays, generally a bismuth mixture. Dr. Teschendorf has made up a fluid capable of stopping x-rays which he sprays on the face before taking an x-ray portrait. This enables him to take a picture of the flesh and bones of the face at the same time. The fluid washes off easily after the x-ray portrait has been taken.

PILOTLESS, full-sized and radio-controlled airplanes capable of exceeding 100 miles an hour and reaching altitudes as high as 10,000 feet have been developed for anti-aircraft target practise by the British Air Ministry. The robot planes have the flight characteristics of the familiar Tiger and Moth types. Equipped with 130 horsepower motors, they can take off either from an airport or by catapult from an airplane carrier at sea. In flight the planes sweep in great circles, with a maximum radius of ten miles, at all times under radio control from staff officers on the ground.

PACIFIC OCEAN bottom rock is different from rocks found anywhere else, whether on land or under other oceans. It appears to be the earth's real foundation rock, overlaid elsewhere with other deposits which are missing throughout the area of the world's greatest ocean. These are conclusions reached by Dr. B. Gutenberg, of the California Institute of Technology, as a result of a long study of the rate at which earthquake and explosion waves travel through the earth's crust in various regions. The denser the rock the more rapidly the waves travel. Everywhere except in the Pacific region the slower rate of rock wave movement indicates the presence of a "continental layer," says Dr. Gutenberg. This continental layer consists of two parts: an upper set of strata composed of sandstones, limestones and other sedimentary rocks; and a lower, thicker section made up of denser crystalline rocks like granite and basalt. Beneath this continental layer lies the real "rock bottom" of the earth's crust, called the "sial" by students of earth structure, made up of rocks of the class known as peridotites.



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SCIENCE NEWS

*Science Service, Washington, D. C.*PAPERS AT THE SAN FRANCISCO MEETING
OF THE AMERICAN CHEMICAL
SOCIETY

COOPERATION, unity with the rest of the living world, rather than isolation and "rugged individualism," will be the keynote of future progress in chemical science as in all other branches of human activity, Professor W. A. Noyes, veteran chemist of the University of Illinois, told his colleagues at the San Francisco meeting of the American Chemical Society on August 19. The occasion was the presentation to Professor Noyes of the highest honor in the gift of American chemists, the Priestley Medal and Award. Responding, Professor Noyes spoke on "The Way Forward in Chemistry." He invoked the idea of "holism," once popular in medieval theological-philosophical doctrine, to convey the concept of a grand unity emanating from God and taking in the whole world. The same word has latterly been revived by biological philosophers to convey the idea of living animals and plants carrying on their life processes by virtue of being integrated wholes, rather than through the interaction of physiologically separate parts. Professor Noyes proposed a third "holism"—a doctrine of intellectual and social activities based on scientific principles rather than on theological doctrine. "One of the most important characteristics of this method is that the individual endeavors to free himself from all personal and national prejudices," he said. "We recognize the value of such a spirit in dealing with international relations. It is the indispensable foundation for justice in all our affairs. The way forward for chemistry is not that we shall think of it as an isolated branch of science and as independent of the rest of our lives. The days when isolation and 'rugged individualism' were appropriate are passed. We must have instead unselfish cooperation in service for each other. The two outstanding problems to be solved by our generation are the abolition of war and a better distribution of the products of our industries. We have no right to bury ourselves in chemistry and think we are under no obligation to contribute to the solution of these problems. . . . There can be no doubt that the nations of America and of Western Europe are abundantly able to furnish work and a reasonable standard of life for all their people. It is absurd that during the last fifteen years millions of men and women have been unemployed and dependent on 'relief.' We as chemists should contribute our part to the solution of this problem."

VITAMIN E, the fertility vitamin without which female animals can not produce young, appears to be one of the higher alcohols. Evidence to that effect was presented by Drs. H. M. Evans, O. H. Emerson and G. A. Emerson, of the University of California. They made a concentrated extract of the vitamin-containing substance from wheat germs, known to be rich in vitamin E, and then by suitable chemical manipulation produced a crystalline substance so potent that laboratory animals were relieved

of their sterility by a single dose of three milligrams—a less-than-pinhead sized bit. Analysis of the substance showed it to be a quite complex higher alcohol, each molecule containing 29 atoms of carbon, 50 atoms of hydrogen and 2 of oxygen. Ordinary ethyl, or grain alcohol, has a much smaller molecule, consisting of 2 atoms of carbon, 6 of hydrogen and 1 of oxygen.

PROFESSOR E. R. NORRIS and Mary Simpson, of the University of Washington, reported on their investigation of the vitamin content of seaweed. Seaweed is used as food in various parts of the earth, they pointed out, and indirectly it serves as a vitamin source for all the fish and other animal life of the sea. It is therefore of practical importance to know that several species of seaweed, including those commonly used as human food, are at least fair sources of the scurvy-preventing vitamin C, and also contain vitamin B.

THE results of research on spinach and rhubarb were presented in a joint paper by Drs. D. K. Tressler and G. L. Mack, of the New York State Agricultural Experiment Station, and Dr. C. G. King, of the University of Pittsburgh. Spinach is not just spinach. When it is raised in upland gardens it contains about 50 per cent. more vitamin C than is found in spinach raised on muck land. Also, how long it has been on the market is a matter of considerable dietetic importance, for when held at ordinary room temperatures it loses half of its vitamin C in three days and practically all of it in a week. This difficulty can be overcome by chilling, however; spinach kept in a good refrigerator showed very little vitamin C loss. Age at harvesting was not found to be much of a factor, nor was there any significant difference in vitamin content between different named varieties of spinach. The vitamin was found practically altogether in the leaves; very little was present in the stems. The vitamin C content of rhubarb was practically constant, regardless of state of maturity. Neither was there any notable difference between the two garden varieties tested.

CHOW MEIN, a stand-by of Oriental restaurants, may be unknown in China, but it is an excellent source of vitamins and a balanced meal in itself, according to Dr. LeRoy S. Weatherby and S. Murray, of the University of Southern California. Five white rats were fed on a diet of chow mein exclusively for six months after weaning. They showed no diet deficiency during the entire period and grew normally, although a trifle more slowly than rats fed on other balanced diets. This slight slowness in growth was probably due to the composition of chow mein, which is 82.63 per cent. moisture, and consequently lacking in solid matter. Other experiments with groups of white rats showed that chow mein is not only rich in vitamins A, B and D, but is also sufficiently supplied with minerals and proteins necessary to health. Five grams of chow mein a day, in addition to a basal

diet, was fed to each rat in several groups. In the first group, it was sufficient to produce a normal growth curve for each rat. A gain of 4.5 grams in weight a week, for eight weeks was recorded for each rat in a second group, together with the disappearance of nervous symptoms present before the test. Complete cure of rickets was effected in four weeks in a third group.

VITAMIN C, preventive of scurvy, may also have an important rôle in the physiology of sex. A hint in this direction was contained in a report presented before the meeting of the American Chemical Society recently, by Drs. David Glick and G. R. Biskind, of Mount Zion Hospital of San Francisco. It is as yet no more than a hint, however; much further research will be required to demonstrate whether or not it actually has such a function. The suggestion arose out of researches, with very delicate microchemical technique, on the distribution of the vitamins in the body's ductless glands. It was found that the vitamin C content of the ovaries increased and diminished with their physiological rhythm. Perhaps of even greater importance was the discovery that vitamin C is stored in highest concentration in the pituitary gland. This gland is a small lump of tissue, situated at the base of the brain. It has been called the "driver gland" because its activities control such a large number of bodily functions. Among its many activities is a strong dominance of the sex glands. The apparatus and methods used by Drs. Glick and Biskind were devised in Copenhagen by two Danish biochemists, Drs. K. Linderstrøm-Lang and Heinz Holter, of the Carlsberg Laboratory. Their work is looked upon as remarkably delicate and accurate by their American colleagues.

PAINFUL sunburn, blistering and burning the skin of normal individuals, can be lessened or prevented by the administration of doses of iron, Dr. Howard L. Eder, of the Santa Barbara Clinic, told the American Chemical Society meeting at San Francisco. Iron therapy will also increase the resistance to sunburn of individuals more than normally susceptible to the sun's ultra-violet rays. By using iron, fair, red-haired individuals, usually chronic sufferers from freckles and blistering, can be made to stand an average exposure. Cases known to be sensitive to sunburn were tested before and after being given the iron treatments. There was a marked increase of ultra-violet ray tolerance after the treatment, as well as improvement in color, appetite and other signs of health. Ruddy, bronzed skin replaced raw, inflamed tissue. Citing clinical cases to demonstrate his point, Dr. Eder said that observations indicate the blood of the human body to be "a parasite, living on other body tissues." If such is the case, the hemoglobin test now in use is not a sure way of learning a person's iron reserve, or signs of anemia, since the blood hemoglobin would maintain itself as long as it could draw upon iron reserves of the other organs of the body to supply its needs. Thus a person may suffer from lack of sufficient iron in the body, and still be able to make a good showing in the hemoglobin test. This might explain some cases having the earmarks of anemia, and yet with no apparent lack of iron in the blood.

X-RAYS, scattering upon striking atmospheric dust, warn of the deadly particles of free silica that make certain industrial jobs extra-hazardous, according to Professor G. L. Clark and D. H. Reynolds, of the University of Illinois. Other dusts make the air thick and produce much discomfort, but the real peril to workmen comes from free or uncombined silica. Methods hitherto in use by public health investigators have been difficult and sometimes not particularly dependable. X-ray scattering or diffraction, however, is claimed to be both more rapid and more sure than any hitherto employed. The method depends on the fact that when a thin beam of x-rays strikes any substance it is diffracted or scattered, and that each substance has its own characteristic "diffraction pattern." The pattern produced by x-rays passing through a mass of silica particles, for instance, can not be duplicated by any other substance.

COFFEE goes stale as it grows old because of the action of oxygen on the aromatic fatty substance in the beans that is responsible for their delicate flavor. It is a process analogous to the spoiling of butter. The only thing you can do about it is be sure you get freshly roasted coffee. These results were reported by Dr. Robert O. Bengis, of Yale University. Experimental procedure followed by Dr. Bengis was basically simple. He extracted the fatty substance from a lot of freshly roasted coffee beans, and later on made a similar extraction from beans out of the same batch, when they had gone stale. Each sample of the extracted substance he exposed to oxygen, in an apparatus that would show how much of the gas the sample absorbed. The fresh material absorbed more than did the extract from the stale coffee, showing that the latter had already taken up a measurable quantity of oxygen, during the process of staling. Similar tests on coffee marketed in vacuum tins showed that this method of packing affords only partial protection to the coffee. Even with the best of commercial vacuums, there seems to be some air left—enough, at any rate, to start oxidation in the aromatic fatty substance. Vacuum packing therefore, in Dr. Bengis' opinion, serves only to retard the staling process and will not stop it altogether.

THE discovery of a source of sugar in dahlias, claimed to be commercially practicable, was reported by Dr. LeRoy S. Weatherby and Dr. Wray M. Rieger, of the University of Southern California. Levulose, the kind of sugar which can be made from dahlias, is nearly twice as sweet as the ordinary cane or beet sugar. It will therefore give people who wish to reduce or remain slim the same sweetness with less weight-adding calories, and save money while doing it. Also, since doctors believe flower or fruit sugar to be oxidized more easily than any other kind, its commercial production may bring relief to many sufferers from diabetes. That sugar can be obtained from dahlias and other fleshy-rooted flowers has been known for some time. Some years ago, chemists of the National Bureau of Standards worked out a process for making inulin from the roots of the Jerusalem artichoke, a kind of sunflower. Dahlias and sunflowers are members of the same plant family. Two different processes have

been worked out for the making of dahlia sugar. In one, the juice of the heated dahlia roots is extracted with a large hydraulic press, and the inulin or "dahlia-starch" contained in the juice converted to sugar syrup. In the other, the inulin is converted into sugar within the tubers or roots, and then extracted by means of diffusion batteries, as is done in the manufacture of beet sugar. This process may have a special commercial value because of its adaptability to use in beet sugar factories already built, which now waste large amounts of valuable plant space during the idle season. Dahlias have approximately the same yield of roots to the acre as sugar beets when properly cultivated. California is well suited for the production of dahlia sugar because of the abundance of dahlias in gardens of the state. One dahlia garden now has seventeen acres under cultivation, and others could easily be grown on short notice.

COOL homes in hot summers may result from a process that makes ice out of live steam in a fraction of a second. In its present stage of experimental development the process is still too costly for practical use, but engineers are working hard to perfect it mechanically and also to make it economically feasible. The vacuum refrigeration process was described by D. H. Jackson, of the Croll-Reynolds Company, New York, one of several firms now carrying on research in this field. In producing the high vacuum necessary to obtain the low temperatures, steam is forced through small jets at velocities as high as 4,000 feet a second—nearly twice the speed of an army rifle bullet. Although the jets are only a few inches long, the temperatures drop so rapidly that ice crystals actually form in them, and icicles hang from their ends. At first, high-pressure boilers were necessary for the production of the steam, but lately progress has been made toward the use of low-pressure boilers of the domestic heating-plant type. If their use can be made fully practicable, it may well be that fires will be kept up under home boilers in summer as well as in winter, the steam being used for the formation of ice, and the latter in its turn cooling water to circulate through radiators of modified design, thus accomplishing house cooling with use of heating equipment and doing away with the necessity for installing costly and bulky air ducts. Experiments are also being made with the vacuum cooling of milk, both in the pre-pasteurizing and post-pasteurizing stages. One of the advantages already discernible is a reduction of the amount of water in the milk, thus raising the proportions of butter-fat and dissolved food substances.

PLYWOOD panels, long popular for use in indoor finishing in houses, which can now be used for out of doors, were described by L. A. Sontag and A. J. Norton, industrial chemists of North Tonawanda, N. Y. Plywood is a sort of wooden "club sandwich," made by gluing together three or more thin layers of wood cut with a veneer knife. It is light and strong, and has been found an excellent material for various kinds of light construction work. But since the glue is water-soluble and also subject to the attacks of fungi, termites and other destroying

agencies, plywood has never been much used where the weather can get at it. This is all changed now. A new type of glue, known as phenolic resin, is proof against both weather and fungi, and resists the attack of termites. Hitherto it has not been possible to use phenolic resin glues, principally because heat as well as pressure had to be applied to make them work. Now, however, hot presses are available in sizes suitable for making large sheets of plywood, so that manufacture of the new style can proceed.

ZINC and paint are chemically hostile to each other and that is why the average householder finds it so difficult and expensive to keep his zinc-coated eavetroughs decently painted up. Dr. Henry J. Wing, chemist at the works of E. I. du Pont de Nemours and Company, Wilmington, Del., reported an investigation in which he started with the commonly observed fact that paint flaking off zinc-coated metal is covered on its contact side with a white film. Then he made the purest and smoothest zinc surface possible, by coating small pieces of glass on one side with zinc in the same way that aluminum is used to form reflectors for modern astronomical telescopes. These he exposed to fumes from ordinary paint. The same white stuff formed on the mirror surfaces. Upon analysis this was found to be zinc formate, a compound of zinc and formic acid. Analysis of the white stuff from "natural" paint flakes off the surface of galvanized iron showed the same substance to be present. Paint removed from plain iron did not have it. This solved the riddles, but the answer has not yet been forthcoming. Before paint chemists can know how to make paint stick to zinc further research will be necessary.

RECOVERY of gold from solutions where it is present in as small amounts as one part in four billion was reported by Dr. William E. Caldwell, of Oregon State College. Describing his process and its possibilities, Dr. Caldwell said that it makes possible rapid and accurate recovery of better than 95 per cent. of the gold in solution, and will be useful in removing gold from ores with a low percentage of gold content. Since tests indicated that it was possible to recover up to 1/3,000,000 of an ounce of gold from 10.5 gallons of water, or one part in four billion, it was decided to apply the process to sea water. Accordingly samples were pumped from Puget Sound and yielded from 1/1,500,000 to 1/250,000 of an ounce for each metric ton of water. In other words, there is less than a tenth of a cent's worth of gold at the present market value in each ton of sea water. While the new process has proved its ability to extract gold from sea water, no claim is made that it can do so on a paying basis. In the process, mercuric chloride and other chemicals are added to the solution containing gold, forming a precipitate which settles to the bottom where filtering, siphoning or other methods can recover it. Addition of lead and heating cause a minute gold bead to form. The same method can be used to recover silver dissolved or suspended in minute quantities in solutions, although with not quite as high degree of accuracy.

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SCIENCE NEWS

Science Service, Washington, D. C.

THE DOUBLE FUNCTION OF GENES

GENES, the invisible units of heredity, do double duty. They determine the expression of the body's thousands of characters, such as color of hair or eyes, and they also serve a general purpose in merely keeping you alive. If every gene needed for every special purpose were not also present in every cell, even where it is not needed, you just wouldn't be alive at all.

This double function of genes was brought out in discussion by Dr. M. Demerec, of the Carnegie Institution of Washington, speaking at Woods Hole, at the meeting of the Genetics Society of America.

Every cell in the body contains exactly the same set of genes as every other set. The cells in your toes have the same hair-color genes as the cells on the top of your head. But just because you have no hair on your toes is no indication that those particular genes are lacking there. If they were not present the cells themselves would not exist. There would not be any toes. There would not even be any you. And so for all the rest of the genes everywhere.

The discussion was conducted in an endeavor to find out more about the working of genes—how they operate to make our hair blond or brunette, our eyes blue or brown, our legs long or short, our dispositions placid or vehement. Genetics thus met embryology.

Genes act like enzymes, which are chemical agents that change things without themselves being changed. The digestive ferment pepsin is an example of an enzyme. But genes are not enzymes, chemically speaking, most of the speakers contend. They are much more complex in their makeup and they increase and multiply themselves which ordinary enzymes are unable to do. It is considered more likely that they create special enzymes and work through them to produce their effects on body development.

Dr. Calvin Bridges, of the Carnegie Institution of Washington, displayed microscope slides showing the interior of cell nuclei, in illustration of the way in which genes not only reproduce themselves but also may produce entirely new genes. Dr. Bridges has suggested that evolution began with a single gene, and that this, by multiplication and changes in its chemical nature, eventually gave rise to the thousands of diverse genes found in the most advanced animals and plants. These changes may have come about through the impact of radium rays or other active forces of nature.

Dr. Charles B. Davenport, of the Carnegie Institution of Washington, showed a number of large-scale charts of living cells, showing changes in material lying directly on the outside of the nuclei. These, he suggested, indicate how the genes in the nuclei exert chemical influences on events outside themselves, and thus determine the course of bodily development.

FRANK THONE

MALE SEX HORMONES AND THE PREVENTION OF ABNORMALITIES

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MALE sex characters will be brought under control in their development, and distressing abnormalities will be subjected to experiments looking toward their elimination from the human stock, as the result of discoveries made in Swiss and Netherlands laboratories, reported at the meeting of the American Chemical Society, by Dr. L. Ruzicka, of Zurich.

The basis of his statement is the definite determination of the chemical composition of a male sex hormone isolated last June by Professor Ernst Laqueur, of Holland. In the opinion of Dr. Ruzicka, the synthetic preparation of this hormone in sufficient quantities to provide ample material for studies of its effect in treating sexual abnormalities of male human beings will be merely a routine matter requiring a few weeks or months.

This hormone is the second chemical messenger having to do with the development of male sex characters upon which Dr. Ruzicka has worked. The first was isolated from kidney secretion in 1931 by the German chemist Dr. M. Butenandt. In 1934 Dr. Ruzicka and his assistants succeeded in producing this hormone in the laboratory from cholesterol, a widely distributed organic substance found abundantly in the yolks of eggs.

Through the experimental material thus provided, it was possible to demonstrate that there must be two male sex hormones, one present in kidney secretion and the other in the sex glands themselves. The isolation of this second hormone proved to be difficult, partly because it occurred in such small quantities, roughly in the ratio of one part in a million of glandular tissue.

Comparison of the effect of the artificially produced hormone with that occurring naturally in the tissue of male sex glands indicated that the difference between them was more a matter of potency than of chemical nature. In the light of this and other findings, Dr. Ruzicka explained, he predicted the empirical formula of the second hormone and prepared some of it in the laboratory.

When Professor Laqueur succeeded in isolating the naturally formed hormone from gland substance he found that it conformed closely to the formula predicted by Dr. Ruzicka, and the natural hormone could be converted into the substance prepared by Dr. Ruzicka by a simple process of oxidation.

As a result of these studies, Dr. Ruzicka stated, it is safe to say that both sex hormones can be manufactured in the laboratory. Both of them, like theelin, the female sex hormone, are derivatives of the widely occurring substance cholesterol. The male hormones differ in formula by two atoms of hydrogen. The female hormone contains six less atoms of hydrogen and one less of carbon, but has not yet been prepared synthetically.

The action of the second male sex hormone is so powerful that it will increase the weight of certain sex organ

tissues in abnormal rats by more than four thousand per cent. Whatever use may be made of it in the treatment of human beings, Dr. Ruzicka warns, will have to await results of long and careful experimenting.

GEORGE A. PETTITT

EXPERIMENTS WITH A NEW TREATMENT FOR MEASLES

No suitable measure for dealing with the most infectious of all childhood diseases—measles—had been found until recent experiments with a protein material obtained from the bodies of human mothers have been reported.

New-born babies do not have measles, but the immunity, evidently derived from their mothers, disappears very early. Measles and the complications that follow it are then acknowledged as among the most dangerous of all diseases of infancy and early childhood.

Encouraging evidence regarding the new treatment reaches the medical world through the *Journal* of the American Medical Association. The medical publication devotes a major article, a scientific report from its council on pharmacy and chemistry and an editorial to this important new preparation.

Dr. Irving W. Levitas, a specialist in children's diseases, Westwood, N. J., describes twenty-eight cases of fully developed measles treated with the new substance. Of these twenty-five children were greatly benefitted, particularly in regard to cough and toxicity. When Dr. Levitas gave the new treatment to eighteen other children one or two days after they were exposed to measles, he was able to modify the course of the disease so that in fifteen cases the symptoms were extremely mild. Then the substance, in larger dosage, was given to twelve children exposed to the measles in a hospital ward. After the injection of the substance, none of them "took" the disease.

In a preliminary report, the Council of Pharmacy and Chemistry of the American Medical Association considers the new substance, which is a placental extract first used experimentally by Dr. C. H. McKann and his co-workers. It regards the product as a promising immunizing agent. Both the council and the editor of the *Journal*, however, think it too early for doctors to put the extract in general use, until further evidence of its value is available.

THE PETROLEUM RESERVES OF THE UNITED STATES

FEARS of an imminent gasoline shortage in the United States, with skyrocketing prices, are held exaggerated by government economists, statisticians and petroleum specialists in Washington.

Commenting in response to Science Service inquiries, they said they could not agree with Dr. Benjamin T. Brooks, chemical engineer, and L. C. Snyder, geologist, both of New York, who predicted before the American Chemical Society, meeting in San Francisco, that a serious petroleum shortage will arise some time between 1940 and 1943.

The prevailing opinion among persons conversant with the petroleum industry is that while America will undoubtedly be faced with a shortage of natural petroleum

at some time, it will be a great deal further in the future than five years.

According to figures of the U. S. Geological Survey, the known petroleum reserves of the United States, excluding unproven areas and unknown potentials, are about 13½ billion barrels. Since the normal rate of consumption is roughly one billion barrels a year, this supply would last at least 13 years, if no new fields were discovered.

New oil fields are now being discovered, giving an addition of approximately 600,000,000 barrels each year. This, to be sure, is not enough to supply our demand without tapping our reserves, but it is enough to make our reserves last a great deal longer than 13 years.

Consumption may rise, of course. The estimates of the Petroleum Administrative Board for the months of July and August show that it will probably reach an all-time peak for the history of the United States, with about 42,000,000 barrels consumed each month. Consumption is usually higher in the summer months, however, and there will be a dropping off with the approach of winter.

As for a rise in prices due to shortage of petroleum, and its predicted effect of less consumption of gasoline, and small, low-powered automobiles, government statisticians have not been able to discover any link between gasoline consumption and price, or between petroleum supply and price.

Prices in the gasoline field are strictly competitive prices, and not based directly on supply, demand or anything else. Furthermore, there appears to be no relation between price, including state and federal taxes, and petroleum consumption per car, which is roughly 18½ barrels per car each year. For example, in Alabama, the taxes on gasoline are in the neighborhood of nine cents a gallon, and yet there has been no drop in gasoline consumption in that state.

Undoubtedly, at some time in the future the motor cars of the United States will be driven by a motor fuel that is at least partly the result of chemical skill. "Sooner or later a substitute for natural petroleum as the principal source of motor fuel must be found, but what it is, or when it will be commercially practical we don't know," said a member of the Petroleum Administrative Board who refused to be quoted personally.

Shale oil has been mentioned as a possible substitute for petroleum. The prevailing opinion is, however, that while oil distilled from shale is a great potential source of motor fuel, there is no technical process at present capable of recovering it in sufficient amounts and at a cheap enough cost to be practical.

It is believed in government circles that step number one in providing a substitute for petroleum will be the large-scale synthetic production of gasoline by hydrogenation of coal. A number of successful processes for coal hydrogenation have been developed, notably the Bergius process at present being used on a large scale in Germany, and are now being experimented with in America.

MOSAIC DISEASE OF THE SUGARCANE

SUGARCANE fights mosaic disease, one of the worst of the ills that afflicts it, with a virus-paralyzing substance

it forms in the growing tips of its stalks, a stuff that seems to be somewhat analogous to the germ-fighting "anti-bodies" formed in the bodies of human beings and animals when invaded by disease. This discovery has been made by Drs. E. W. Brandes and Julius Matz, plant pathologists of the U. S. Department of Agriculture.

They found that when juice extracted from healthy tissue taken from near the growing tips was mixed with juice from mosaic-sick plants, known to contain the virus, and the mixture then injected into healthy canes, the resulting infection was much less severe than "control" infections caused by unmixed virus-containing juice. The nature of the virus-paralyzing substance is still unknown; as is, indeed, the nature of the virus itself. The latter belongs to the group known to science as "filter-passers," because unlike the true microscopically visible bacteria it can be drawn through fine-grained stone filters without losing its capacity to cause disease.

Recent studies in Louisiana have disclosed that there are at least four varieties or strains of sugarcane mosaic, whereas it used to be thought that there was but one kind. This situation is comparable to that presented by malaria in human beings. Malaria is malaria, but there are three species of microorganisms that cause it, and hence three kinds of malaria.

A report by Drs. Brandes and Matz will be presented at the fifth triennial congress of the International Society of Sugarcane Technologists being held at Brisbane, Australia.

FEDERAL SURVEY OF CHRONIC ILLNESS

THE federal study of chronic illness throughout the country is getting under way and the house-to-house canvass in nineteen states to collect information is scheduled to start on October 15.

The study will be directed by George St. J. Perrott, statistician of the U. S. Public Health Service. In his office workers are preparing and revising charts, tables and forms for collecting data. However, the study, for which \$3,450,000 was appropriated two weeks ago, is really a WPA project and 90 per cent. of the personnel will be taken from the work relief rolls of the various states.

Mr. Perrott has explained the objects of the survey as follows: The population of the country is growing older and more and more people are getting past the age for whooping cough, scarlet fever and other childhood and acute diseases and into the age group where heart disease, rheumatism, diabetes, cancer and digestive disturbances form the chief health problem. There is almost no accurate information as to the extent of these illnesses throughout the country and their effect on economic and social conditions. The health inventory is expected to supply this lack.

Some of the information will be obtained from records of hospitals and sick benefit associations. The rest will come from the house-to-house canvasses of 750,000 families selected to be representative of the general population of various income levels. Besides chronic illness, data will be collected on physical disability, such as blindness, deafness and loss of limbs or other crippling.

The U. S. Public Health Service has already been making an intensive study of the importance and effect of chronic ailments on the capacity of the patient and family to remain self-supporting. The health survey will be correlated with this study to obtain further data.

Headquarters for the house-to-house canvass will be in Detroit. The states to be included are Washington, Oregon, California, Utah, Minnesota, Missouri, Illinois, Michigan, Ohio, Pennsylvania, Maryland, Virginia, New York, New Jersey, Massachusetts, Georgia, Alabama, Louisiana and Texas.

ITEMS

A COMET that may be new to our part of the heavens has been discovered by Professor G. Van Biesbroeck, of the Yerkes Observatory. It is a faint diffuse object in the southeastern evening sky between the constellations of Capricornus and Sagittarius. Moving northwestward in the sky, more observations and computations are necessary to tell whether the comet, now 14th magnitude, will become brighter. Report of the discovery is being distributed to observatories through Harvard College Observatory. The comet has a diameter of 20 seconds and there is a star-like nucleus of three quarters of this diameter.

RAPID CITY, S. D., may be the scene of another stratosphere balloon flight this fall. First official intimation that the National Geographic Society and the U. S. Army Air Corps are considering a new flight is contained in an announcement issued by the society. Those serving on the advisory committee of the attempt of last July are now making a study of weather conditions in the Rapid City area for the last fifteen years. The results of the study will determine whether a new flight will occur during October. A special survey committee has just concluded from its study of the accident that failure of the rip-panel of the balloon, *Explorer II*, was the cause of the recent collapse of the balloon's fabric just before take-off. Only the upper half of the fabric was damaged and the entire top is now being rebuilt by the Goodyear Zeppelin Corporation at Akron, Ohio. The gondola and instruments are all intact and with the fabric again in good shape the take-off awaits only a favorable decision from the weather studies.

BUTANE, propane and other petroleum-gas names now unfamiliar may soon become parts of common speech and consciousness. They are now rather neglected by-products of petroleum refining, but when turned into liquids they can be put to a considerable range of uses, according to the report of W. Z. Friend and T. W. Legatski, of the Phillips Petroleum Company, at the San Francisco meeting of the American Chemical Society. These gases are so versatile that a single supply may first be used as a solvent, then as a refrigerant, and finally consumed as a fuel either for heating or in internal combustion engines. It was pointed out that the consumption of liquefied gases increased 71 per cent. during the year 1932-33, and 73 per cent. in the year 1933-34, and prophesied that under the stimulation of further application their use will be increasingly common in the future.

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PAPERS READ BEFORE THE SIXTH INTERNATIONAL BOTANICAL CONGRESS

SIR E. JOHN RUSSELL, director of the Rothamsted Experimental Station at Harpenden, England, speaking before the Sixth International Botanical Congress, called attention to the fact that plants, constantly sucking upward the water that trickles and oozes downward through the ground, profoundly affect the character of the soil in which they grow. In the eastern part of England the water drainage through cultivated soils is only about half that through uncultivated soils. The whole nature of the soil is affected, and the marked differences between feebly and strongly leached-out soils turn very largely on the intensity of action of plant roots in removing the soil water. Associated with this removal of water is also a transfer of mineral substances and nitrates from the sub-soil to the aerial parts of the plant. Calcium, potassium and silica in particular are lifted in quantity to the leaves and stems: when the plants die they fall back on the surface of the soil. The details vary with individual plants, and in the end striking differences may result. The general result is, however, that this process counteracts the washing down by the rainfall, and it confers upon the soils of mild humid countries one of their characteristic properties that the upper layer tends to be richer in calcium and potassium and to be more nearly neutral than the lower layers. These characters are of profound ecological significance and react greatly upon the vegetation. The plant roots evolve considerable amounts of carbonic acid. This evolution of carbon dioxide is of special importance in dry regions where soils tend to be alkaline, for it offers the possibility of reducing the alkalinity and so profoundly changing the vegetation. Experiments are being tried in various regions to find crops which by evolving large amounts of carbon dioxide from their roots, can be used for the reclamation of alkali soils. Plants also exercise marked influence on each other through their roots. The legumes, or plants of the pea-bean-clover family, not only obtain nitrogen for their own needs through the activities of the bacteria that live in their root nodules, but also excrete it and make it available for other plants. On the other hand, several British investigators have conducted experiments, in which drainage through the perforated bottoms of trays in which plants were growing was permitted to flow over the roots of other plants. The latter were unfavorably affected, either through poisons formed by the roots in the trays, or through their absorption of all available nitrates, or through some combination action resulting finally in a nitrogen poverty. The importance of roots in other connections was also pointed out: weed competition, crop rotations, and the final conversion of dead roots into soil humus.

THE sociology of American plant life in prairies, forests and mountains, was described by Professor H. S. Conard, of Grinnell College. In America, as everywhere in the world, regional differences in climate, soil and other con-

ditions find expression quite as much in plant communities as they do in the cities and states of human beings. Long grass is as natural to Iowa-Nebraska prairies as are farmers raising corn and hogs. Short grass belongs to Montana and Wyoming quite as inevitably as cattlemen. Beech-maple-hemlock forests are as true a sociological expression of Michigan and northern Ohio as are automobile and tire manufacturers. But these plant societies are no more completely uniform than are human societies. There are plenty of local and even individual differences within the broad frame of a general regional type. Groves of bur oak are as truly a part of the prairies as are the wider stretches of long grass, and in the Eastern forests one will find plenty of places where the dominating trees give way to such things as white pines or tulip trees. Moreover, there are plenty of "strangers" that get into seemingly unaccountable places. Thus, far up into the prairies southeastern trees, such as the Kentucky coffee tree, can be found. Or, on Hempstead Plain on Long Island, there are wild grasses, legumes and other plants that are atmospherically "Western." Such seeming aliens can usually be accounted for. The plants from the Southeast that have wandered out into the prairies have followed the moist, rich, sheltered lands that line the stream courses. Such plants are fairly common in the eastern prairies of Illinois and eastern Iowa; in western Iowa and central Nebraska they become rare. The "Westerns" that crop up in the East are usually found on extremely porous soil, which permits the heavier rains of the region to drain right through, producing a set of moisture conditions resembling those of the drier prairies or even the plains. One should not speak of these local "foreign" plant societies as "detached fragments" of East or West. They should be frankly recognized as outliers, as true foreigners, which have kept their own identity but which do not really color the communities into which they have for one reason or another found their way.

THE possibility was suggested of fighting the fungus diseases that now devastate crops by sowing or spraying the germs of counter-diseases. The suggestions came from research laboratories in widely separated parts of the world. Dr. S. D. Garrett, of the University of London, who carried on his studies in Australia on a destructive wheat disease called "take-all," found in certain types of soils a complex of fungi and other obscure organisms useful in combatting the disease. From the University Farm, St. Paul, Minn., Miss Delia E. Johnson reported the antagonism of a newly discovered species of bacterium against the smut diseases of corn and various small grains. A most comprehensive study in the field of microbiological antagonisms was presented by Professor S. Endô, of the University of Tokyo. He has examined dozens of kinds of bacteria and molds for their effects on several different disease-causing microorganisms. Some he has found to be decidedly depressing, others less so; a fair number completely lethal. It may be that bacteri-

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ologists and plant pathologists are ready to take a leaf out of the book of the entomologists, who long ago learned to fight enemy insects by turning their own insect enemies loose upon them.

EVOLUTION appears to be at its most active state in producing new varieties of plant diseases affecting grain crops. What one species of smut fungus can do in the way of producing new strains was outlined by Professor E. C. Stakman, of the University of Minnesota. He described a research project in which a single reproductive cell of this smut fungus was isolated and its offspring propagated in the laboratory. Within a few months there were 162 distinct physiological strains of this one fungus from the single-celled start. These physiological strains of plant-disease fungi are the more difficult to deal with because within a given species they all look alike. They are different only in their behavior. Thus, there is one well-known variety of stem-rust of grain that attacks wheat and barley but not rye and oats, another that attacks rye and barley but not wheat and oats, and still another that attacks oats but none of the other small grains. Under the microscope they all look exactly the same. The multiplication of fungus varieties that occurred with the smut specimen in the laboratory is duplicated thousands of times over in the field. Many new varieties rise by hybridization through sexual crossing of existing varieties, but others occur without interbreeding, through the "straight evolution" process of mutation or "sporting." There is an endless race between the plant breeder and the natural new origin of these plant diseases. The breeder will carefully produce a new crop variety that is resistant to all known diseases—only to have a newly originated disease attack it.

YOUNG plants, cut down and buried in the soil as fertilizer, decay much more quickly than older plants of the same kinds do. This was one of the points discussed by Dr. Selman A. Waksman of the New Jersey Agricultural Experiment Station. In these experiments a number of plants were cut at different stages of growth and definite amounts allowed to undergo decomposition by microorganisms, under identical conditions. Of the young plants, 73 per cent. of their material was decomposed in thirty days, while it took sixty days to decompose only 42 per cent. of the material of older plants. One of the reasons for the difference in decomposition rate is the marked difference in the chemical make-up of older and younger plants. The older plants contain higher proportions of more resistant materials, especially the celluloses and lignins. The latter substances, which are the basis of the "woodiness" of wood, are exceedingly difficult for bacteria, fungi and other microorganisms to digest. Moreover, there is a difference between the lignins of old and young plants; in the younger stages the lignins are chemically "tenderer" and easier to break down. Differences in humus formation in the soil are traceable not only to differences in the plant materials that are decomposed but also in the living agents of decay, the bacteria, molds, protozoa and other microscopic forms. Insects, worms and other larger animals that feed on dead wood and

leaves also aid by chewing them into more manageable morsels for the smaller creatures. The relative abundance of these microorganisms is influenced partly by the nature of the dead plant materials themselves, for some of them like wood, others straw, still others dead leaves; and also by such factors as temperature, moisture, soil ventilation and soil acidity or alkalinity.

WEEDS in a farmer's pasture may be an indication that he does not have the right kind of animals in it. Frequently one kind of farm animal will eat plants rejected by others. Observations of animal feeding habits and the selection of stock that will clean up a particular weed species will aid toward the solution of a weed problem. This suggestion was offered by Dr. Winifred E. Brechley, of the Rothamsted Experimental Station, Harpenden, England. Dr. Brechley has observed, in English pastures, that cattle will eat bracken-fern but will not touch broom-weed, while sheep like broom but will not eat bracken. To blanket the pasture-weed problem, Dr. Brechley recommended running horses, cattle and sheep in the same enclosure. Weeds that can stand up against their combined preferences must be voted hopeless.

GREAT BRITAIN presents a peculiar picture to the student of plant life: a relatively limited assortment of plant species, but a wide variety of climatic and soil conditions, according to Professor A. S. Watt, of the University of Cambridge. These circumstances give rise to some rather unique situations. Since there are fewer plant species, there is a tendency for each one to spread out more. In other lands, especially in the botanically rich North American region, keen competition between species holds each one very close to the habitat it can occupy to the very best advantage. In Great Britain, on the contrary, each species tends to be limited only by climatic and soil conditions, rather than by the competition of its fellow-plants. The great variety of British climate, in a comparatively small area, has brought into close contact species usually thought of as belonging to widely separated regions. In the British Isles plants of Mediterranean affinities rub elbows with almost-Arctic species, and plants that thrive best in damp island climates are found growing close to others that are more characteristic of drier inland countries. The sharp contrast between the soil types of western and eastern parts of the islands tends to accentuate the effects of the climate. At the same session of the Congress Professor J. Braun-Blanquet, of the University of Montpellier, France, compared the principal vegetational types of northwestern Europe with those of northeastern North America. He found striking resemblances between the two regions, both in the kinds of plants that inhabit them and in the soil types on which the vegetations grow.

CALIFORNIA has a whole chain of "plant orphanages," where species of plants are found in limited areas and nowhere else in the world. These were described by Professor W. L. Jepson, of the University of California. All the endemic, or orphan plant, areas were once islands but some of them are now mountains rising up to 6,000 feet

in altitude. The original flora of the geologically-ancient islands has been taken for a gradual slow ride upward without apparently being changed thereby. Of more than 5,000 species of higher plants in the state of California some 2,000 of them are of endemic, or "orphan," types. To show how widely varied is the flora of California it may be recalled that in the whole northeastern quarter of the United States there are only 3,500 species of higher plants altogether. Since the days when Darwin and Wallace popularized the idea of evolution, the rôle of island isolation in enabling new species to develop has been taken as an axiom, among students of the life sciences. Here, then, is an ideal situation for the development of large numbers of unique and solitary species of plants. Many of the areas would not now impress the casual observer as former islands. Some of them are rather lofty mountains. In certain instances these endemic-bearing areas have been elevated from 1,000 to 6,000 feet, carrying their plants with them. And the plants, curiously enough, seem to have been changed relatively little by their slow ride high into the air.

X-RAYING plants to produce hereditary changes in their offspring is not limited in its effects to what happens in the immediate outcome. An x-rayed plant may produce offspring with new peculiarities, such as changed leaf-size or flower-color, which will duly appear in subsequent generations. But these generations may also begin to produce other changes, even without being x-rayed themselves. Changes of this character, and an explanation for them, were described by Professor T. H. Goodspeed, of the University of California, one of the pioneers in the field of x-ray genetics. While the details of the process are highly technical, the essential fact underlying the three types of cellular change is a state of instability, of continuing change, induced in the chromosomes by the first impact of the x-ray bombardment.

MOUNTAINS in mid-Sahara are not the sun-baked piles of barren rock which popular imagination, fed by Hollywood versions of the Foreign Legion, has pictured them. They manage somehow to gather enough moisture to support vegetation, even a growth of trees. Professor René Maire, of the University of Algiers, told of his explorations in what is probably the least-known botanical region of the world, the high mountains of central and southern Sahara, which rise to heights of 6,500 to 10,000 feet. Earlier travelers' tales had clothed them with "forests" of pistachio and cypress pine, trees unknown in the New World. Under the more critical botanical eye of Professor Maire, these forests dwindled to a thinner growth, mostly of pistachio and a kind of desert cypress. He did not deny, however, that denser forest growth may once have existed there, in a bygone age when the Sahara itself was a grassland instead of a desert. Among the trees, and above them on the treeless mountain-tops, were lower growths of shrubs. Prominent among them the exploring botanist found a bush botanically related to the sagebrush of western North America. In general, Professor Maire stated, the vegetation of these mountains has been derived from that of the shores of the Mediterranean.

ITEMS

THE increasing magnitude of chemical research is the latest sign pointing to improved economic conditions. Professor E. J. Crane, of Ohio State University, head of the international reporting system of the American Chemical Society, announced that during the first six months of 1935 the number of research projects completed was ten per cent. greater than in the first half of 1934. Abstracts of chemical reports from all parts of the world numbered 20,342 this year as compared to 18,664 during the first six months last year. A staff of 400 men scattered over the globe is required to keep the abstracts of chemical research up to date.

FLUORESCENT light, the luminescence given off by plants when they are subjected to ultra-violet and certain other kinds of rays, may yield a clue to the still unsolved riddle of how plants capture and use sunlight in making their own food out of water and carbon dioxide. This was the suggestion laid before the American Chemical Society by Dr. James Franck, German physicist, who shared in the Nobel Prize for physics in 1925. A plant's food-making activity and its fluorescence, Dr. Franck pointed out, are inversely proportional to each other. The greater the amount of sun-energy plants re-emit as light, the less they have to use in the tiny food-factories in their green cells.

PROFESSOR R. NORRIS SHREVE and M. W. Swaney, of Purdue University, have tied mercury to what chemists know as the pyrrol ring, a relatively simple-organic hook-up somewhat resembling benzol in composition. They find that their mercury-pyrrol compounds are highly effective in their germ-killing power, and that they have the advantage over mercury-benzol compounds of being more easily soluble in water and other fluids in common use as germicide solvents.

FOSSIL insects by the thousand have been found in a sandstone stratum near the mouth of the Mezer River, on the Arctic coast of the U. S. S. R. The remains of wings constitute the majority of the fossils, but casts of bodies are abundant also, and there are a few plant fossils as well. Professor A. G. Marynov, a leading Russian entomologist, has made a partial study of the specimens, and states that all Paleozoic families of insects are represented. The sandstone layer has been identified as of Permian date, that is, of the age immediately following the great Coal Age. Insect-bearing deposits of similar age have been found in Kansas, in the United States. Most abundant among the fossils are primitive cockroaches. Early forms of grasshoppers, dragonflies, scorpion flies and other primitive insect orders are also well represented. Entomologists regard the few small beetles present as of especial interest. Several entirely new fossil species have already been identified. An expedition of the Russian Academy of Sciences is at present in the region making further studies and collections.

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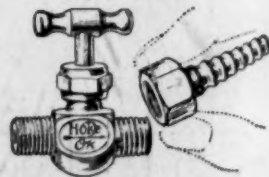
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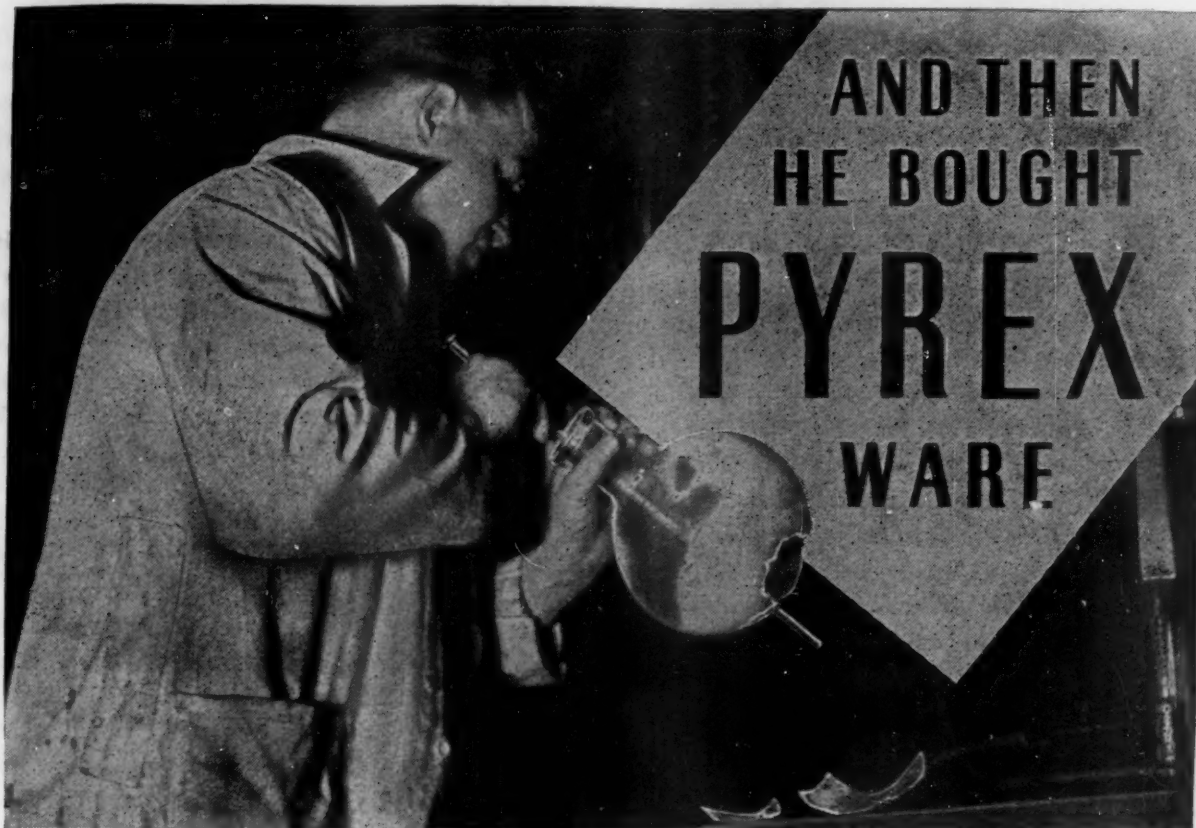
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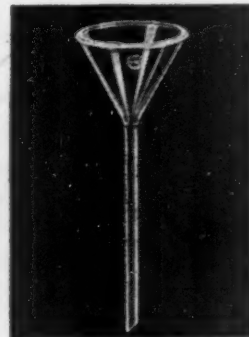
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SCIENCE NEWS

Science Service, Washington, D. C.

SOME PAPERS READ BEFORE THE NORWICH MEETING OF THE BRITISH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

PREPARATION of 99 per cent. pure "heavy" neon, the gaseous element most widely known for its use in reddish advertising signs, was announced before the meeting of the British Association for the Advancement of Science by Dr. Gustav Hertz, of the Siemens-Halske Company, Berlin. The achievement is comparable with the concentration of pure heavy hydrogen for which Professor Harold C. Urey, Columbia University, recently was awarded the Nobel Prize in chemistry, because of the importance of neon in experiments on atomic structure. Ordinary neon gas consists of two isotopes, which are chemically indistinguishable but have different atomic weights. The lighter and predominating fraction has an atomic weight of 20 and the heavier one weight of 22. As found naturally, they occur in the proportion of nine to one, respectively, and give the average atomic weight of 20.2. Dr. Hertz's concentration of the mass 22 kind of neon makes the second isotope now separated into usable quantities. The heavy isotope of hydrogen is the other. Samples of the almost pure heavy neon have already been given to Professor F. W. Aston, of the University of Cambridge. Another sample is being sent to Dr. Kenneth Bainbridge, of Bartol Research Foundation, Swarthmore, Pa., for analysis on his mass-spectrograph. Professor Ernest O. Lawrence, of the University of California, may also receive some of the heavy neon for experiments in nuclear physics. Commenting on the concentrated heavy isotope of neon, Professor Aston called the work a great aid to experiments on nuclear disintegration, because by using the heavy neon gas, investigators can be sure that its weight is unambiguously 22. Recent work has shown that nuclear studies such as artificial radioactivity and transmutation ought to be done, for best results, with really pure elements; the word pure being used in its physical as well as chemical meaning. Dr. Hertz uses the diffusion technique for separating the neon isotopes. A battery of tubes containing porous material is filled with chemically pure neon gas as obtained from the chemist. Mercury vapor pumps drive the neon through the system. As the gas comes to the porous material, the lighter kind of neon passes through a little faster than the heavier kind because of the difference in the diffusion rates. The lighter fraction passes back to the opposite side of the porous tube and repeats the process while the heavier fraction passes on to the second porous tube, then to a third, and so on. Each porous tube has the return system whereby the lighter isotope is each time returned to repeat the diffusing process. Continuous operation and circulation of the gases is maintained by the pumping system. Starting with the original neon gas in the ratio of 9.3 parts of isotope of mass 20 to one part of isotope of mass 22,

only one hour is needed to bring them to equal concentrations. Five hours suffice to bring the heavier isotope up to 98 to 99 per cent. concentration.—*Watson Davis.*

New fields of research in stratosphere balloon ascensions should include studies to see if neutrons are being shot out by the sun, according to Lord Rutherford of Nelson, head of Cavendish Laboratory, Cambridge. In laboratory experiments neutrons, fundamental units of matter out of which atoms are composed, make possible the transmutation of one element into another. It might be possible to detect neutrons from the sun high in the earth's atmosphere and they should be looked for as high as scientists can reach in manned and unmanned balloons. If neutrons occur in the sun and the other stars of the universe, they should be very effective in causing breaking down and building up processes among the elements by the atomic transformation discovered by Madame Curie-Joliot and her husband, M. Joliot, in their Paris laboratory, Lord Rutherford also suggested. The fears of investigators that the physical laws of the conservation of energy do not hold in experiments on atomic collisions are rapidly lessening. Up until last year, he pointed out, certain tests seemed to indicate that more energy was liberated in some types of atomic collisions than was put into them. In his opinion, Lord Rutherford continued, recent studies on the nucleus of atoms justify the assumption that the conservation of energy holds for all atomic transformations. New measurements on the masses of atoms by Professor F. W. Aston at the University of Cambridge in particular, Lord Rutherford indicated, have shown that the masses of some elements were not previously known with sufficient precision. Such lack of knowledge, if not proving definitely that the conservation law holds, plainly strengthens the case for the hitherto basic principle of physical science.—*Watson Davis.*

Dr. P. B. Moon reported that "cold" neutrons, cooled to the temperature of liquid oxygen at minus 130 degrees below zero Fahrenheit, are the latest means of increasing the efficiency of artificial radioactivity bombardments in the laboratory. Temperature profoundly changes the ability of the newly-discovered neutron particles to cause radioactivity when they are used as atomic bullets. Artificial radioactivity produced by atom bombardment causes the atoms of the struck element to give off beta and gamma rays like those which come spontaneously from the naturally radioactive elements like radium and thorium. Aside from the technical aids to the study of atomic nuclei in such experiments, there is always, in the background, the hope that if the process can be made efficient enough, mankind will at last have an artificial substitute for expensive radium. And thereby the radiation therapy of cancer will be benefited. Discoveries of ways to increase the efficiency of the artificial radioactive

effect by neutron bombardments have been several and rapid. It is now known that if the neutrons can be slowed up by passing them through paraffin-wax and water before they impact on the element being activated, the radioactive effect is increased. Much energy is lost by bringing about this multiple bumping about in hydrogen-containing materials, but the final result seems to be that after being slowed down the neutrons are much more efficient in transferring their remaining energy to the atoms of the target. The suggestion has been advanced, Dr. Moon pointed out, that the neutrons might be so slow that they had only energy equivalent to the ever-present thermal agitation of the material through which they were going. If this were so, the efficiency of the neutrons as radioactivity producers should depend on their temperature. Dr. Moon reports that this effect has been definitely shown by experiments wherein the artificial beta ray activity of silver was increased some 30 per cent. if the neutrons producing it are cooled to the temperature of liquid air.

MANKIND'S earliest cradle will be sought in Central Asia by the noted French student of human pre-history, Père P. Teilhard de Chardin, who will take the field this fall. This announcement was made by Sir Arthur Smith Woodward, of the British Museum, in the course of his address as president of the section on anthropology. The project was originated by the late Dr. Davidson Black, who first gave to the world the scientific details of the ancient skeletons now known as Peking Man. He planned to make a careful study of the pre-glacial Tertiary deposits in south Central Asia, and in 1932 actually traveled overland from China to Syria, passing through the region under consideration. Unfortunately, he died before he could carry out his project, and Père Teilhard, who was closely associated with him in the last few years of his scientific work, has undertaken to see it through. The central Asiatic uplands are indicated as a promising place to explore for the remains of earliest man for more than one reason. Sir Arthur called attention to a supporting basic principle in the study of evolution laid down by the late Dr. W. D. Matthew, of the University of California. Dr. Matthew pointed out that it would be reasonable to expect the highest evolved forms of a given line of development to be in or near the place of original development, and that lower forms would be found at the outer fringes of its total area of distribution. The relatively few remains of very early man that have been found form a rough circle around Central Asia: they include Piltdown Man in England; the Heidelberg Man in Germany, the Peking Man in China and the Trinil Man in Java. Central Asia is a "good bet" for manward evolution from a possible ape-like ancestral stock, on grounds of geologic history, Sir Arthur continued, citing in support earlier workers. He said that "The east-to-west ridge of the Himalayan Mountains was gradually raised up at the time when northern India was covered with a great forest which swarmed with apes of many kinds. The formation of the ridge separated off a northern portion of the forest which became subject to comparatively inclement conditions. The apes stranded in this northern

portion would be disturbed by the extensive destruction of the trees, and the survivors would be driven to be ground-apes and change their habits of feeding. They would thus be modified in the direction of man. Regarded from the zoological point of view, of course, man is an arboreal mammal which has left the forest. His remote ancestors, by continuing to live in the forest, preserved their jaws, teeth and limbs nearly on the primitive mammalian plan while the brain alone made progress."

DR. F. J. W. WHIPPLE, of Kew Observatory, stated that deep-focus earthquakes occurring hundreds of miles inside the earth instead of merely in the comparatively thin upper crust of rock are being intensively studied by seismologists. Most earthquakes recorded on the seismological stations throughout the world originate, Dr. Whipple said, less than 31 miles below the earth's surface. Quakes at deep-foci start many times deeper than this. In Japan especially, he pointed out, studies show that these deep quakes are distributed in a very remarkable way, indicating that there exist well-defined flaws in the earth at depths of from 62 to 180 miles and far below the level of isostatic compensation. Such new findings are among the most spectacular of recent advances. The reason is that present beliefs tend to picture the solid rocky crust of the earth as floating on a denser semi-plastic material lower down. As one part of the crust sank down into the material, there was a compensating uplifting somewhere else on the earth. Mountain ranges such as the Himalayas appear still to be undergoing this lifting process. That the underlying semi-plastic material might itself have well-defined flaws still lower was hardly considered until the recent discoveries based on the way earthquake waves are transmitted through the earth.

THE Sahara Desert is spreading southward well over a half mile a year. During the past 300 years the torrid sands have encroached some 186 miles into what was once fertile farm and grazing land. Unwise methods of farming, grazing and forest use are making a present of some of the best lands in Central Africa to the Sahara Desert, according to Professor E. P. Stebbing, of the University of Edinburgh. Professor Stebbing's observations were made during a tour last year through parts of several British and French colonies in West Africa. Three factors, in his opinion, contribute most heavily toward this encroachment of the desert on lands once fit for human occupation. The natives practise what is called "shifting agriculture." They clear a piece of land, burn the felled trees, cultivate the soil for a year or two or three, then move on to repeat the performance elsewhere, leaving the abandoned clearing to grow up into "bush." The forest does not take it back. A second factor is the further destruction of the forests by fires deliberately set. Increasing populations depending on cattle, sheep and goats have introduced the third factor, overgrazing. Stripped of its binding cover of grass, the soil dries out. Water fails, both for the restoration of the range and for the replenishment of the wells.

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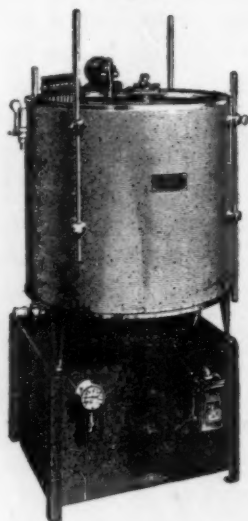
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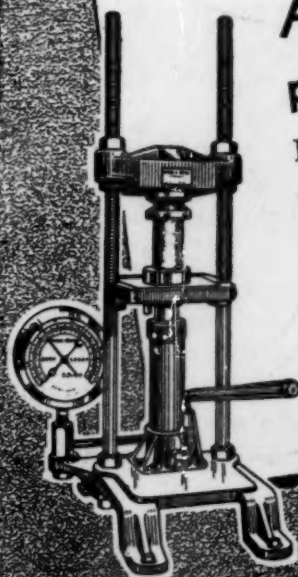
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SCIENCE NEWS

Science Service, Washington, D. C.

SOME PAPERS READ BEFORE THE MEETING OF THE PACIFIC DIVISION OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Do the still mysterious cosmic rays cause the light of the sky at night? Science is gradually accumulating evidence which rules out scattered sunlight as the source of this "night light." Night light is the faint but distinguishable radiation which comes from the space between stars. It is separate and distinct from the aurora borealis, although its colors resemble the latter. Dr. Joseph Kaplan, of the University of California, at the meeting at Los Angeles of the Pacific Division of the American Association for the Advancement of Science, stated that new studies on the midnight maximum of "night light" removes the sun as a possible cause of this nocturnal glow. It was formerly believed that the sun's radiation striking atoms high up in the region above the stratosphere excited them during the daytime, and that after sundown they gradually released this stored-up energy in the form of light. Dr. Kaplan believes, however, that cosmic rays cause the "night light." Most of the cosmic ray energy, as is known by the extensive researches of Dr. Robert A. Millikan, Dr. A. H. Compton and other investigators, is absorbed high in the upper atmosphere where the light of the night sky originates. In his laboratory, Dr. Kaplan has been able to produce a glow discharge in evacuated tubes whose light is the duplicate of the aurora borealis and is now studying means of duplicating, on earth, the much weaker "night light." If Dr. Kaplan's theory that cosmic rays cause the light of nocturnal sky is correct, a new means may be found for studying the very penetrating cosmic radiation. But if "night light" may turn out to be an aid to the cosmic ray studies, it is and has ever been a nuisance to astronomers, for it limits the length of time that photographic plates can be exposed to study very faint stellar objects. The "night light" forms a continuous background which gradually fogs the astronomical plates.—*(Copyright, 1935, by Science Service.)*

ARE the distant nebulae redder than the nearer ones because they are receding with enormous speed or, as many would like to believe, is there some other explanation such as attributing the red shift to the action of electrons in free space? Professor Roy Kennedy and Walter Barkas, of the University of Washington, announced that they had tested the matter experimentally and found that electrons could not be held responsible because there are not enough of them. They used an interferometer, designed by Professor Kennedy, that is capable of detecting a change of a billionth of an inch in a foot. Still no effect of electrons could be seen even with millions of millions present. Professor R. C. Tolman, the new president of the Pacific Division, announced that he and Dr. Edwin P. Hubble, who was recently awarded the Barnard medal for his work on the red shift,

were practically convinced that no known effect other than recession of the nebulae was competent to account for the observations of the red shift.

A NEW discovery promising to revolutionize the whole costly and lengthy procedure of finishing large and accurate mirrors for giant telescopes was announced by Dr. John Strong and Professor Enrique Gaviola, of the California Institute of Technology. Instead of rubbing and grinding a spherical mirror for months or even years until it attains the desired parabolic shape, the new Strong-Gaviola method is to deposit just enough aluminum on the mirror in just the right places to change the sphere to a parabola. The amount to be deposited can be calculated in advance instead of using the tedious cut-and-try methods of grinding of the old opticians. If something goes wrong, instead of reworking the whole mirror, it is only necessary to remove the aluminum and repeat the process. The method is an outgrowth of Dr. Strong's technique for evaporating aluminum on large glass mirrors in a vacuum to attain better light-gathering power through all of the spectrum. Dr. Gaviola, who is visiting professor from Buenos Aires, has been assisting him in this work. The first attempt to turn a spherical mirror into a parabolic one by evaporation has now been completed with complete success. Drs. Strong and Gaviola used a mirror twelve inches in diameter for the test. There are great technical difficulties in handling very large mirrors, but the limit has not nearly been reached in the present case. The evaporation technique may change the practice of the design of optical instruments. Other shapes of telescope mirror surfaces can be made besides parabolas. Hyperbolas, for example, can be constructed. At present mirrors of this shape present enormous constructional difficulties, especially when they are off center, and are avoided at all costs. Yet they have their uses in astronomical research.

Now that large astronomical mirrors have been coated with aluminum and tried out, a group of astronomers and physicists got together at the meeting and compared notes. Dr. Strong, who has aluminized all the big astronomical mirrors so far, described some of the processes involved. The main thing is to get a good vacuum and an absolutely clean surface for the aluminum to stick to. Then just the right amount of aluminum has to be melted on the right size of tungsten wire and the wire heated until the aluminum has boiled off in all directions. Professor Hiram Edwards, of the University of California at Los Angeles, told how he happened to find a most favorable alloy of magnesium and aluminum to deposit by evaporation in a vacuum. He found the reflecting power of the alloy to be remarkably constant and equal, for visible light, to the unheard-of value of 94 per cent. This is 4 per cent. higher than aluminum. Astronomers from various observatories pointed out newly found advantages for aluminum. No mirrors have deteriorated so far. They have proved easy to clean of dust and they per-

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W. F. DREA. Spectrum analysis of hen eggs and chick tissues.

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mitted longer exposures because of the cleanness of the pictures photographed. One mirror on a sun telescope had to be treated with optical rouge every week while it had a silver surface, but during the last year and a half since it was aluminized it required no attention. The full investigation of all the benefits of aluminum will probably not be completed for years.

A FLAMING piece of cotton can be held in the hand, provided it is first immersed in a mixture of two parts carbon tetrachloride and one part of carbon bisulphide. But drop the cotton as soon as the chemicals have burned off. This magician-like stunt was part of the lecture given by Professor R. W. Wood, of the Johns Hopkins University, Baltimore, who described the eccentricities of high explosives. He also demonstrated an explosion which occurs at the relatively low temperature of boiling water, at 212 degrees Fahrenheit. Particularly violent among explosions is the outburst of fulminate detonators. When such firing devices blow up, their cap is shot off at three times the speed of a rifle bullet. By photography Professor Wood has proved that when explosives are set off they first send out weak light of extremely short duration and then remain dark for a period of less than a ten thousandth of a second. Finally they burst forth with a blaze and a bang. This second burning progresses along the explosive sometimes as fast as four miles a second.

THE meeting, sponsored jointly by the American Physical Society and the Astronomical Society of the Pacific, discussed the different ways of determining the approximate "birthday of the earth" over a thousand million years ago. One technique is called the "hour glass" method since it is based on the amount and rate of sedimentation laid down by erosion over millions of years. It is comparable to measuring time by using the flow of sand through an hour glass. The difficulty is that no one can be sure that the rate of sedimentation was anywhere near constant through the long periods of time involved, according to Dr. George D. Louderback, of the University of California. Much more accurate is the radioactive "time clock" method described by Dr. Robley Evans, of the Massachusetts Institute of Technology. Certain rocks of the earth contain the elements thorium and uranium, which continually disintegrate and finally form lead. The rate of doing that is unchanged by any natural phenomena yet found by science. Thus, the ratio of the lead to the thorium or uranium present is a measure of how old the rock is. It is still more accurate to measure the amount of the gas helium present in the sample. This gas is formed as the radioactive elements break down and shoot off alpha particles which are really the cores of helium atoms. Finally, the impact of the alpha particles on the surrounding material forms, over long periods of time, very small haloes or rings. Some specimens of mica show these rings very well. The age of the sample can be determined by studying the size and fineness of these haloes. All these methods, as well as others based on astronomical considerations, indicate

that the age of the earth is between 1,850,000,000 and 3,500,000,000 years.

PROFESSOR VERN KNUDSEN, of the University of California at Los Angeles, spoke of the most recent developments in the study of sound. A peculiarity of sound is the minute energy required for audibility. When the volume of sound changes, its pitch seems to change and this is difficult to explain by the otherwise satisfactory theory of hearing now worked out. This theory envisages the ear as a string instrument. Each separate string or fiber responds best to a separate note and its agitation is transmitted by nerves to the brain. The fibers can not vibrate continuously but must have rest of one thousandth of a second between spasms of agitation. The apparent loudness of a sound depends not only on the energy of the source and the sensitivity of the listener, but also on the medium in between. Professor Knudsen described some of his own pioneering research on this question which he said depends on some theoretical results of Einstein over ten years ago. The usual medium through which we hear sound is air and the amount absorbed by the air depends largely on the small percentages of water it contains. Moist air absorbs much less than dry air. This means that the humidity of large auditoriums must be limited to diminish reverberation which is so important. It also explains the majestic quiet of the desert the dry air of which may absorb an ordinary sound so that it is almost a million times as weak at a distance an eighth of a mile as it would have been without the absorption. Carbon dioxide is still worse and reduces high notes ten thousand-fold in a distance of ten feet. This is the most absorbing gas so far found by Professor Knudsen.

THE mechanism of heredity is explained according to the most modern ideas of the biologists in terms of little blobs strung along on fibers which exist within each living cell like beads on a string. The blobs are called genes and the string of them is a chromosome. Professor Th. Dobzhansky, of the California Institute of Technology, summarized recent research in this field. The genes, he stated, are as fundamental for the geneticist as atoms for the physicist or chemist; just as definite conclusions can be drawn as to their separate existence as is possible in these other fields about atoms. Moreover, conclusions of the biologists from indirect experiments and reasoning can be verified by a direct view of giant chromosomes recently discovered in the salivary glands of the fruit fly. This is more than the chemist can ever hope to do with his atoms. The biologists found that their reasoning had been quite correct as to the order of the genes in the chromosomes but that the distances between them sometimes were off a little. These distances are not so important but the order is. The chromosome is more than an aggregate of genes because the same genes arranged differently will give different species which may be sterile when bred together. Evolutionary changes in the order of the genes is constantly going on. Professor Dobzhansky emphasized that the matter of order or relative position is an important factor hitherto disregarded.

POSSIBILITY of assaying maleness on the basis of female sex hormone production by the male body is suggested by the description of various glands and their hormones given by Professor B. M. Allen, of the University of California at Los Angeles. Professor Allen reviewed the entire field of hormones, dwelling particularly on those produced by the pituitary, thyroid and sex glands. The sex glands are associated with hormones characteristic of the male and the female, but recent research indicates that it is not only the sex glands which produce the hormone. A man may produce both male and female sex hormones and so may a woman. This corresponds to the observation that a certain degree of effeminacy is found in men and masculinity in women. Some men produce female hormones almost exclusively and this seems to match other aspects of their behavior. From these observations arises the suggestion that in the relative amount of female sex hormone produced in a man's body is to be found the measure of his masculinity. Professor Allen warned that these studies are very new and much more work will have to be done along this line before final conclusions can be drawn. X-rays and nicotine also influence production of hormones and tend to diminish it. The effect of injection of hormones varies in surprising ways. A small dose of hormone might produce a big change in certain tissues of experimental animals whereas ten thousand times the dose might produce no effect at all. Pituitary is a misnomer for the small but important gland in the head which exercises control over the other ductless glands and over body growth in general. Pituitary is a word of Latin origin meaning cold in the head.

DR. KARL MEYER, of the Hooper Foundation, University of California, stated that California and other western states must continue their drive against wild rodents, especially the ground squirrel, in order to protect themselves and the rest of the country against plague which is always present among these animals. Plague is nature's way of regulating the population of rodents which otherwise multiply with extreme rapidity. Domestic rats may share nests with squirrels and so become infected through the fleas of which the average squirrel harbors about twenty. It is the flea which generally carries the disease from rat to man. In the great bubonic plague of 1665, however, the infection was probably from man to man. The plague which in that pandemic killed off a quarter of Europe is, however, no longer a socially important disease. The infection in the domestic rat is on the wane but the selvatic form, which is the infection from wild rodents, is an ever-present danger. Outside of the Orient the current foci of plague are South Africa, Argentina and California. Both state and federal health departments are active in campaigning against the millions of rodents which infest the western states, and which are infected to the extent of 2 per cent. with plague, mostly in the pneumonic form.

ITEMS

RAPID CITY, S. D., has been selected as the site for another flight to the stratosphere next October, according

to an announcement made by the National Geographic Society. Studies of the weather conditions at Strato-bowl, in the Black Hills, for the last fifteen years disclose that October usually has periods of good weather long enough to make the flight a fair possibility. In the decision which will send the Society-Army Air Corps balloon *Explorer II* aloft again, Rapid City won out over Scott Field, Illinois, as the take-off site. Much of the equipment is still at Rapid City, and it had been decided that if weather conditions at the two places were at all comparable for October the South Dakota site would again be used. The entire top of the *Explorer II* is being rebuilt in the Goodyear Zeppelin factories in Akron, Ohio, and will be delivered to Rapid City some time in early September.

FIRST scanty details of the design of the sixteen giant airplanes which will take the place of the ill-fated *Maxim Gorky* have been released by the Soviet Government. The new planes will be of the all-metal monoplane type powered by six engines, each of 1,200 horsepower. The *Maxim Gorky* had eight engines of 850 horsepower each. Designed to carry from 60 to 70 passengers, the new planes will have a top speed of 167 miles an hour. The wing-span of each "ship" will be 206 feet, the over-all height 36 feet, the length 111 feet and the distance between the landing wheels 34 feet. As planned the new airplanes will operate in horizontal flight, at normal load, with two of the six engines out of order. Robot pilots, blind-flight instruments and equipment for night landings will be provided.

DUTCH ELM DISEASE is still a potential menace outside the zone around New York City where the major eradication efforts have to be concentrated because of the gravity of the infestation there. Two isolated outbreaks, one of nine infected trees in Indianapolis, Ind., the other of two trees in Norfolk, Va., have been reported to the U. S. Department of Agriculture. These trees have been destroyed, and scouts are hunting in their respective neighborhoods for others that may still be bearing the disease. The scouting and eradication campaign conducted by the Bureau of Entomology and Plant Quarantine, U. S. Department of Agriculture, has now reached impressive proportions. In the infested area, covering parts of Connecticut, New York and New Jersey, a total of over 1,700 square miles has been scouted to date, and specimens from more than 30,000 suspected trees have been collected and sent in to the laboratories for examination. About a third of these have received positive identification and the trees have been destroyed.

SPEAKING before the British Association for the Advancement of Science, E. W. Gilbert called attention to the fact that Britain has been in possession of other Mediterranean islands besides Malta. During the stormy, war-filled eighteenth century, England took possession of the Spanish island of Menorca on three different occasions. Even yet there are surviving relics of these periods of occupation, in the use of English sash windows, and in the presence of about a hundred English words, mostly quite corrupted, in the islanders' vocabulary.

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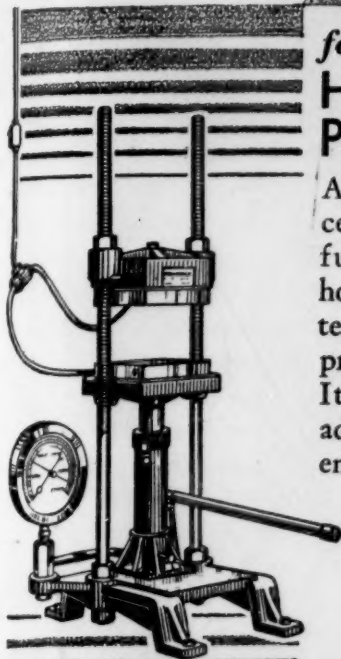
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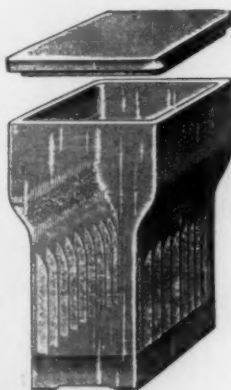
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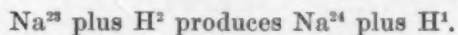
THEORY CONCERNING THE EFFECTS OF DEUTERON "BULLETS"

MODERN alchemy, the transmutation of one chemical element into another by bombardment with high-speed subatomic "bullets," is made possible by an electrical sorting arrangement inside each atom. How the subatomic sorter helps weed out parts of the incoming atom bullets and allows others to enter the nucleus and create a different, heavier atom, is explained in a new theory just announced at the University of California at Berkeley.

Drs. J. R. Oppenheimer and M. Phillips, in the *Physical Review*, described how their explanation of the sorter's operation clears up a mystery of certain puzzling experiments performed by their colleagues, Professor E. O. Lawrence, Dr. Edwin McMillan and Dr. R. L. Thornton.

Professor Lawrence's research had found many cases where an element, bombarded with deuterons from his giant sling-shot accelerator, was increased in mass by a unit of one. Thus, aluminum of mass 27, when struck by a deuteron of mass two, turned into aluminum of mass 28 and released a hydrogen particle of mass one, a proton.

Similarly sodium, whose chemical symbol is Na, entered into bombardment reactions of the type:



In each case part of the deuteron (H^2) was captured and went to form a heavier atom, while the rest of the deuteron turned into a proton (H^1).

As explanation, Drs. Oppenheimer and Phillips suggest that the deuteron is not really a single particle but a composite unit containing a neutron and a proton; the proton having electrical charge and the neutron being without one. Don't think of the deuteron, however, as a round, hard particle; for its wavelike nature means it is not confined to a sharply limited volume. As a matter of fact, there is a good chance that both, or either, the neutron or proton, of which the deuteron is composed, may be some distance away from the deuteron's center of mass.

Coming up to an atom in the target, say an aluminum atom, the neutron and proton in the deuteron particle behave quite differently. The strong electrical barrier of the atom nucleus stops the charged particle, the proton; but it has no effect on the non-electrical neutron. The latter goes right through the barrier, enters the aluminum nucleus, is captured, and in joining creates a new and heavier kind of aluminum.

One way to think of the atomic happening is to conceive an army half of which consists of men with gas masks and half without. The army is attacking an enemy whose sole defense is a cloud of poison gas thrown up around it. The attacking force comes to the gas cloud. Those parts of the deuteron army with gas masks (the neutrons) can go through the gas (electrical barrier). Those parts without masks (protons) must stay outside and retreat. The analogy falls down in that one deuteron does not consist of many neutrons and protons but only of a single

pair. A stream of deuteron particles, however, might be likened to the attacking army pictured.

RECENT INCREASE IN MENTAL DISEASE NOT DUE TO THE DEPRESSION

THE number of new cases of mental disease admitted to the hospitals in New York State has increased from 6,300 in 1912 to about 12,000 in 1934, a 27 per cent. increase in the rate per 100,000 of population.

The increase in mental disease is not due to the mental strain and stress of the depression, however, Dr. Carney Landis, research associate in psychology for the New York Psychiatric Institute and Hospital, said in an address—broadcast over the Columbia System—under the auspices of Science Service.

Only one type of mental disease has increased materially in this period: a disease which affects only persons past middle age and is due to the hardening of the blood vessels in the brain. The rate for patients sent to mental hospitals on account of this disease has skyrocketed from less than 2 per 100,000 in 1912 to over 14 per 100,000 in 1934, a jump of almost 700 per cent. in 22 years.

Why are more people suffering from hardening of the arteries in the brain? We can not blame that on the depression, Dr. Landis said. It is explained by the simple fact that the United States now has many more people old enough to be subject to this disease than were living in 1912. In 1912 about one fifth of the population was 45 years old or older. In 1934 practically one quarter of the population was in this age group.

We have more old people now because public health work and preventive medicine have added more than 10 years to the life span of the average American since 1900, Dr. Landis indicated. "After all, a man must die of something, and if typhoid does not take him at 30, hardening of the arteries in the brain may at 60," he said.

"Depression, financial insecurity, unemployment, and general unrest have not led to any increase in hospitalized insanity," Dr. Landis concluded. "This does not mean that there has not been plenty of mental stress and anguish, plenty of ragged nerves and unhappiness, but these psychological stresses and tensions have not led to an increased rate of hospitalized mental disease."

NOISE CAUSES DEAFNESS BY DAMAGE TO NERVE

CONTINUOUS exposure to constant noise of sufficient loudness will cause deafness due to nerve damage, Dr. M. H. Lurie, of Harvard University, told members of the American Academy of Ophthalmology and Otolaryngology at their meeting in Cincinnati.

By listening in with a special kind of radio hook-up on the hearing apparatus of cats' ears, Dr. Lurie and associates were able to learn much about the causes of different kinds of deafness. Some of their conclusions are: (1) Deafness of adult life can be caused by the neglect of mild ear trouble of childhood. (2) Exposure of people

ple to loud noises for long periods of time will cause a dying of the sensitive hearing cells in the ear, followed by deafness. (3) Certain diseases and drugs, typhoid fever, mumps, influenza, quinine and alcohol, cause actual destruction of the nerve endings of the inner ear. (4) Explosions can dislocate these special hearing cells, throwing them off from the vibrating membrane on which they rest. (5) Unregulated noise over long periods may seriously injure the nerves by which we hear.

In the course of the experiments the investigators found in the animals tested all the different types of deafness that human beings have. These included the inherited type of deafness; deafness caused by disease of the drum and bones of the ear that bring the sound to the inner ear; the chronic deafness caused by repeated colds; deafness in which the nerve of hearing itself is involved; and loss of hearing as a result of the animal hearing loud noises for a long period of time.

Besides studying these various kinds of deafness with the super-radio apparatus, the investigators examined the animals' ears microscopically in order to find, if possible, the exact causes of the conditions.

HEIGHT OF THE FOREHEAD

DR. ALEŠ HRDLÍČKA, anthropologist of the U. S. National Museum, in the annual report of the Smithsonian Institution, states that measurements on many hundreds of skulls in the museum collections, as well as on the heads of living men and women, show that the average forehead height of "Old Americans" of the white race is 2½ inches. American Indians have foreheads hardly a thumbnail-thickness higher. But American Negroes have foreheads averaging 2¼ inches high, and Eskimos 2½ inches.

Averages among various white races show Armenians to be the lowest-browed, with 2½ inch foreheads. Irishmen have the highest foreheads, 2½ inches. Hungarians and Frenchmen rank next to Armenians as "lowbrows"; Old Americans and Germans next to the Irish as "highbrows."

But lest any one take undue credit to himself for racial superiority in forehead height, Dr. Hrdlička makes it clear that this measurement has nothing to do with intellectuality. He measured four groups: Old Americans at large, representing the "average citizen" of native stock; Tennessee highlanders, a group much retarded educationally; Old American members of the National Academy of Sciences, and academy members without regard to race. The latter two groups, of course, may be presumed to be the very cream of American intellectual life.

Their foreheads were all of almost exactly the same average height. There wasn't a twelfth of an inch difference in the forehead heights of the four groups. And the averages for the Old Americans in the Academy and the Old Americans from the Tennessee mountains were precisely the same!

IMPROVEMENT IN RUST-RESISTING QUALITIES OF MOTOR CAR FINISHES

LIKE the owner of the one-horse shay who built his vehicle so well that it finally all wore out at the same

instant, manufacturers of modern automobiles are gradually solving the problems of wear and weathering and making the journey from the assembly line to the automobile graveyard a longer and more beautiful one.

F. P. Spruance, of the American Chemical Paint Co., speaking at the meeting, in Cleveland, of the Society of Automotive Engineers, described advances in making motor car paint and accessories long-wearing and rust-resistant.

Automobile bodies rust because paint is sufficiently porous to permit moisture to get through to the metal surface. Once the moisture reaches the steel beneath, rust-creating conditions are at hand.

Electrolysis sets in and the iron in the steel dissolves out at innumerable anodic, or positive, electrical points and plates out, even under paint and lacquer at the cathodic, or negative, electrical points. This battery-like action of rusting goes on continually and is stopped only by the removal of the moisture.

The newest way of attacking this sub-paint rusting process is to coat the steel in some fashion with a protecting non-rusting metal coating.

An electrolytic process known as the Granode method is particularly successful. In the Granode process the protecting coating is developed electrolytically from a solution of zinc phosphate. The parts to be coated are hung on hooks in this solution and an alternating current passed through the zinc phosphate electrolyte.

A direct current would deposit zinc directly on the parts; the alternating current coats the metal with a continuous cover of the zinc phosphate. This cover is as rust-resistant as zinc itself but, unlike zinc, will take a coat of paint.

Cheaper than the Granode process and almost as satisfactory, is the Cromodine process, wherein the steel is dipped or sprayed with a solution of iron chromate and becomes coated with a thin layer which is little more than a slight discoloration.

Especially advantageous to the user is the flexibility of the chromium-treated surfaces. It is as pliable as the steel beneath it. A mudguard just tipped on the front end, which may buckle in the middle, will have no spreading paint crack at the bend.

DIESEL-POWERED MOTOR CARS

ADD to your vocabulary—cetene number! You've heard of octane number in rating the bumpiness, or knocking power, of your gasoline. Cetene number is the same thing for the fuel oil in Diesel engines. You'll hear more of cetene number as the gasoline resources of the nation diminish and transportation turns more and more to Diesel-propelled vehicles. Already fuel engineers of Pennsylvania State College are studying Diesel fuels and their characteristics. They are preparing for a condition now nearly at hand in truck and bus transportation, and which will some day come to pleasure cars.

Professor P. H. Schweitzer and his research associate, Theodore B. Hetzel, of the School of Engineering, explain that bumpiness in Diesel fuel is caused by an almost opposite happening from that which causes the comparable knock in gasoline. Gasoline knock—and the ac-

companying octane rating—comes about because the gasoline starts to burn evenly in the automobile cylinder, and then suddenly the unburned part explodes all at once with the resulting knock.

For smooth combustion with a knocking gasoline, the burning of the gas must be retarded. Tetra ethyl lead will bring about this deceleration and is widely used for the purpose. With Diesel fuel, combustion is not set off by spark plugs—there is none—but by the spontaneous ignition due to compression of the fuel which raises its temperature above that needed to make it explode.

If too much fuel spontaneously explodes at once, there is the knock. The way to stop it is to have the fuel burn as soon after it enters the cylinder as possible; speed up combustion instead of slowing it down as is the case for gasoline. To test the comparative values of Diesel fuel, the important point is to measure the ignition lag, the time between the injection of the fuel and its ignition, and make it as small as possible.

The contribution of Professor Schweitzer and Mr. Hetzel is the development of an ignition lag indicator which employs the principles of a phonograph pick-up device used with a radio loudspeaker. One pick-up is connected to the fuel injection nozzle and gives a surge of current when the fuel first enters; the other is connected to a small diaphragm on the walls of the firing cylinder and indicates when the fuel ignites. Standard Diesel fuels and special laboratory test fuels are compared for performance over a wide range of compression values within the testing engine.

ITEMS

CORN has gained a lap in its end-of-the-season sprint with frost, the weekly summary of crop-weather of the U. S. Weather Bureau shows. The situation this season was made more than ordinarily critical because of the persistent cold, wet weather that greatly delayed planting last spring. In spite of the generally optimistic outlook, the lateness of the crop in some areas leaves it still very backward. Thus, in southern Iowa very little corn is yet within sight of safety, while in the northern part of the state the crop is in quite satisfactory condition. The warm weather has been favorable for fall preparation for next spring's crop in most of the major agricultural sections, and farm work is going ahead fast. In the Southeast, however, there has been some delay in cotton operations because of wet weather.

THREE Texas farmers are each \$5 richer because two physicists of the California Institute of Technology released six stratosphere balloons, each carrying cosmic ray recording apparatus, at Fort Sam Houston during August. Dr. Robert A. Millikan and Dr. H. Victor Neher had notes attached to self-recording electroscopes offering a reward of \$5 for their return to Pasadena. B. I. Klein, of Mountain Home, Texas, recovered the first instrument returned. Records made by the device on motion picture film showed that it soared to an altitude of 63,000 feet, the highest reached of the three instruments returned. This instrument was found on August 7, the day it was

released. Names of the other finders were not revealed. The second instrument returned reached an altitude of 48,000, and the third went to 42,000 feet.

AN electric light bulb which is said to provide the rickets-preventing vitamin D without burning, tanning or in any way changing the appearance or texture of the skin made its first public appearance at the convention of the Illuminating Engineering Society at Cincinnati. The new bulb was developed by Dr. George S. Sperti, working at the laboratories of the General Foods Corporation. The bulb can be used in any electric lamp socket without additional fixtures and the full value of the ultra-violet rays can be obtained, it is claimed, while using the bulb in an ordinary reading lamp. The bulb is the result of ten years of experiments on selective radiation. A special corex glass envelope or bulb filters out the light rays below 2,800 Angstrom units. It is these lower wave-lengths, according to Dr. Sperti, that cause damage to human tissue. The new bulb really consists of two bulbs. An inner tube of corex glass operates as a mercury vapor ultra-violet lamp which radiates very little visible light. Within the large outside bulb, also made of corex glass, is a tungsten filament which provides the visible rays.

FLYING-FISH do have movement in their fins while they are in the air, but it does not aid them in their flight. Definite answer to this old and long-disputed argument about flying-fish was given by Dr. G. S. Carter and J. A. H. Mander. The often-observed movement of the flying-fish's fins, they found, is transmitted to them by the tail, which continues to lash the water hard even after most of the fish is clear of the surface. Once in the air, the fins are held rigid, and the "flight" is really a glide. Dissection of a number of specimens confirms these observations. There is nothing about the fin muscles that could give them the necessary movements to make them function as wings.

DUTCH elm disease, which is causing serious alarm and provoking heroic eradication effort in the United States, is not being so earnestly fought in England, where it has been present a longer time. A policy of "let it alone" was approved by T. R. Peach, of the Imperial Forestry Institute, Oxford, speaking before the British Association for the Advancement of Science. The disease, Mr. Peach said, is most serious in the southeast of England. It decreases in severity towards the north and west, and is not known to exist in north England and in Scotland. "In a few limited areas it has done severe damage, but over the bulk of its range, though common, it has as yet killed few trees," the speaker continued. "Prophecy of the future of the disease is complicated by the very varied rate of progress of the attack in different trees, and by the recovery, temporary or permanent, of many. In view of these recoveries and of the difficulties of eradication, a policy of *laissez faire* in this country is probably justified."

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SCIENCE NEWS

Science Service, Washington, D. C.

THE FRUIT FLY IN HAWAII

THE United States has declared war on the Mediterranean fruit fly in Hawaii. With approval by President Roosevelt of a project to use \$80,000 of the funds, derived from the processing tax on sugar, of the Agricultural Adjustment Act, for a campaign against the fruit fly in the mid-Pacific territory, four Honolulu entomologists left September 7 for Washington, whence they will proceed to the jungles of Africa and Brazil in search of parasitic insects that prey on the fruit fly. The parasites, when found, will be brought to Hawaii and set free to attack the fruit fly, which for years has been the major obstacle to the growing of many fruits in this part of the United States.

The project is administered by the Bureau of Entomology, U. S. Department of Agriculture, in cooperation with the territorial board of agriculture and forestry, the University of Hawaii and the Hawaiian Sugar Planters' Association. Though the fruit fly does not attack sugarcane or pineapples, the territory's leading crops, it destroys or damages many soft-skinned fruits which otherwise would thrive in the islands.

The Planters' Association is releasing two of its entomologists, F. A. Bianchi and R. H. van Zwaluwenburg, on a year's leave of absence, to go to Africa with entomologists from the Department of Agriculture in this work. The territorial board is similarly releasing David T. Fullaway, its entomologist and chief plant inspector, who will seek parasites in Brazil. The fourth appointee is Noel Krauss, son of Dr. F. G. Krauss, of the University of Hawaii, who will also go to Africa.

Investigators in Hawaii have achieved many victories over insect pests by introducing parasites which have brought harmful insects under control. Among the pests thus successfully fought have been the sugar-cane borer, the sugar-cane leaf hopper and insects attacking the pineapple. The fight against the fruit fly, if equally successful, is expected to be of great benefit to the small farmers of the territory and greatly to increase the supply of fruits which grow so luxuriantly in Hawaii.

INDUSTRIAL SMOKE A MENACE TO AMATEUR AVIATORS

INDUSTRIAL smoke is a major obstacle blocking the real popularization of aviation: the day when the "little fellow" in his own private plane will take trips by air as he does to-day in his motor car. This in summary is the verdict of H. B. Mellor and L. B. Sisson, smoke experts of the Mellon Institute of Industrial Research.

"A wider use of private planes for ordinary transportation purposes in industrial regions appears more dependent upon securing air freer of smoke and smoke-prolonging fogs than it is upon the use of devices for blind flying and constant radio communication between ship and port."

The present blind-flying apparatus with which the fast commercial transport planes are now equipped would

bring the "little fellow" through smoke-obscured areas if he had them, but, adds the report: "The prospects for giving wireless service to small planes appear to be slim; the little fellow is not being encouraged to install wireless equipment because of the limited number of wavelengths allotted on the band for aviation. Addition of private flyers to the radio service maintained between ships and landing fields would cause congestion and hamper service to the growing number of large passenger, mail and express airliners."

As matters now stand, the pilot of a private plane may have a receiving set and can listen in on weather reports and the two-way communication between transport planes and airports, but he is unable to ask the field for directions that might keep him out of the path of commercial planes which are flying blind.

A private pilot therefore must still depend on his own eyesight. If he can not see a mile or more in every direction, he is in danger every time he gets within range of a well-traveled airline or busy landing field. With radio wavelengths unavailable for the private flier, the solution of the problem involves the more careful location of future airports principally on the windward side of industrial areas.

Hand-in-hand with such a makeshift solution, is the more fundamental problem of reducing smoke in the industrial center. Increased electrification of ground transport, the use of inherently smokeless fuels in domestic and commercial heating plants and the installation of improved equipment now available for the combustion of potentially smoky fuels are the ways smoke reduction can be brought about. All three methods not only aid atmospheric visibility, but are in the direction of economy for the user.

EVOLUTION AND DIET AS THEY AFFECT THE TEETH

A GLOOMY future for the teeth of mankind—a future in which we shall have to pamper our mouths increasingly—is foreseen by Dr. William Seidel, of the U. S. Marine Hospital. Dr. Seidel bases his forecast on existing knowledge of the causes of various dental ills.

Evolution and diet are causing man to lose his teeth, in Dr. Seidel's opinion. Since evolution is an irreversible process, the human oral cavity appears destined to be forever afflicted with caries, pyorrhea and misplaced teeth.

Dr. Seidel points out that the loss of teeth through evolution has been going on for centuries. The great length of time is indicated by the fact that we have already completely lost 16 permanent teeth, having now only 32, while the usual number for mammals is 48. Individually one can lose a good many teeth at one séance with an exodontist, but the evolutionary process is slow, and it has required many centuries to produce such a change in our dentition. This evolutionary change dates back at least to the age of the caveman, and accompanying it there has been a gradual degeneracy of the whole

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masticatory apparatus. The teeth themselves are not anatomically degenerate, with the exception of the third molars, which are often rudimentary; and as some persons do not have third molars, the evolution in dental economy may still be in progress.

Dental caries, or decay, is the most universal and common disease of mankind, and this condition, as well as that of malformed mandibles, is due to the fact that the masticatory organs of modern man have become unfitted properly to perform their functions, according to Dr. Seidel. Not only are the gums and teeth themselves insufficient, but the mandible and maxilla, together with their alveolar bone and sockets, are also deficient.

The mere fact of the high incidence of caries proves the inadaptability of the teeth to modern diet—an inadaptability that is hygienic in character rather than mechanical or physiological. Modern foods do not keep the teeth clean; and nature surely intended that they should be kept clean through natural processes rather than by modern artificial means which are found so necessary to-day. While cleanliness may not be the only factor in decay, it is considered to be the most important one.

In studying the cause of caries, investigators have taken two routes, those on one holding to the belief that bacteriological activity is the essential factor, while those on the other believe that the nutritional and physiological processes hold the clue, a theory supported to some degree by animal experimentation.

Aside from the nutritional aspect as a primary cause, modern diet has two very important secondary effects on the teeth: first, the decreased roughage results in failure in mechanical cleansing; and, second, the increased starch and carbohydrate intake forms plaques on the teeth which make ideal growth media for bacteria. At the present time, according to Dr. Seidel, the best definition and most tenable explanation of caries is that the condition is a decalcification due to the dissolution of the calcium salts of the enamel by the acids formed by the bacteria under the plaques. As the decay reaches the dentine, further deleterious action is produced in the more abundant organic matter there.

AMBULANCE SERVICE FOR ETHIOPIA

AN ambulance unit to aid Ethiopia in the event of war with Italy will, it is hoped, be ready to sail from London soon, according to a report in *The Lancet* by Dr. John M. Melly. A number of people with personal knowledge of conditions in Ethiopia and consequently realizing the appalling prospects have formed a committee to organize the ambulance unit. The object is purely humanitarian and without political bias.

The International Red Cross Committee in Geneva has been consulted and has asked to be kept in close contact with the London committee. The unit being formed will probably be incorporated with the British Red Cross Society if the latter decides to take action in the event of war in Ethiopia.

The skeleton of an Ethiopian Red Cross Society has been formed within the last few weeks, and the ambulance unit being formed in London will work with this society. As

Dr. Melly describes it, the personnel of the Ethiopian Red Cross consists of a few missionary doctors attached to the hospitals at the capital and a dozen or so Ethiopian girls who have been trained as nurses. These, however, could hardly be spared from the understaffed hospitals at Addis Ababa, and the fighting would be many weeks' journey away.

"Ethiopia has virtually no means of looking after her casualties," Dr. Melly points out. "The plight of the wounded on the field of battle would beggar description. The whole country is overrun with hyenas and jackals, apart from the larger wild beasts, and there is no doubt that those wounded who survived until night would become a prey to these animals."

The native doctors are absolutely untrained in the European sense of the word and there are not enough European medical men in the country to take care of all the sick in ordinary times. It is because of this situation that the ambulance unit is being formed. Much preliminary work and organization has been done, and volunteers are being interviewed daily and all preparations are being made in case of war.

It is planned to have the unit disembark at Berbera, in British Somaliland, and proceed by truck to Harrar, where the first field hospital will be established. Casualty clearing stations will be pushed out southeastward from there. The line of retreat will probably be due west from Harrar toward Addis Ababa, and the next situation for the field hospital is expected to be Asba Tafari in Chercher Province. Arrangements for the unit's transport into the fighting area over various routes, according to the season and condition of the roads, are already being made by an advance liaison officer.

ITEMS

THE greatest outburst of sun-spot activity since last summer is sweeping the sun, according to photographs obtained at the Naval Observatory. Above the sun's equator, on what would be the northern hemisphere of the earth, a giant streamer extends from 47 to 82 degrees of longitude, or over one sixth of the sun's diameter. The streamer's length is approximately 144,000 miles. Also in the northern latitudes of the sun is a sun-spot group moving, as is customary, from east to west. Coupled with the increased sun-spot activity has been a succession of moderately severe magnetic storms, according to reports from the U. S. Coast and Geodetic magnetic station at Cheltenham, Md. "These storms," reports W. M. McFarland, "seem to be a recurrence of the magnetic activity of late August and late July. There is often an interval of about 27 days between these recurrences, and sometimes such a group of magnetic disturbances will continue to occur for several years with this 27-day interval between the appearances. The present group of disturbances seems to have appeared first about two months ago."

CORN is apparently winning its race with frost this fall. Through most of the corn belt the crop is already more than half over the safety line, and in certain areas, as in northern Iowa, 90 per cent. of the grain is sufficiently

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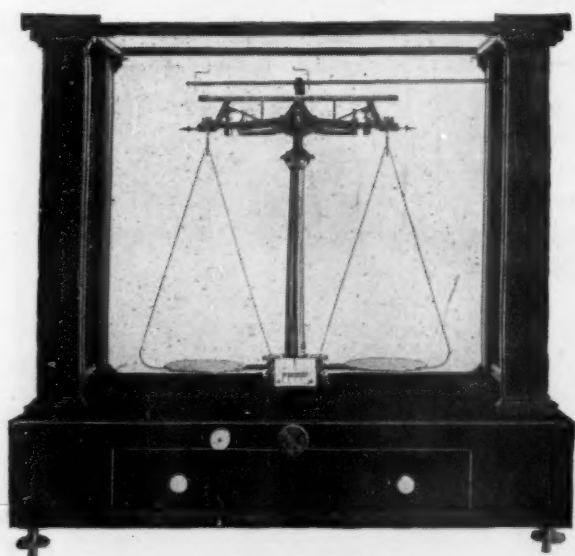
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mature to defy freezing weather. Warm, dry weather over the country generally for another week has helped toward the goal. In the South, cotton is showing good progress, and although picking is late it is now getting well under way. The dry weather has spread over the Southeast, where until this week persistent rains have hampered field work. While absence of rain has thus been helping the harvesting of late crops, it has imposed a handicap on fall plowing in some parts of the country, and has thus delayed the seeding of winter grains.

DEATH and disease are the worst enemies along the impending Italian-Ethiopian battle lines, according to reports on disease conditions in Addis Ababa as communicated in consular reports to the U. S. Public Health Service. Epidemics of typhus fever, relapsing fever and smallpox are harassing the Ethiopian capital and surrounding country, according to the latest report. The number of cases or even of deaths in these three epidemics is unknown, as no statistics on sickness, deaths or births are collected. Vaccination against smallpox is not practised. Leprosy is very common in Ethiopia. So are venereal diseases, and syphilis is reported to be more prevalent there than in any other country. It is said that 90 per cent. of the adult population is affected by some venereal disease. Malaria of course is always present. Tuberculosis, grippe, pneumonia, quinsy, asthma and dysentery are other diseases reported prevalent. Practically all the adults in the country have tape-worms.

AN extra-strong wooden ship, whose ultimate duty will be to become frozen in Arctic ice and drift with the ice fields into high latitudes, will be completed early in 1937, Professor Wiese, the Soviet explorer, has announced. In general the design of the ship will follow that of the *Fram* used for similar duty by the Nansen expedition to the Arctic in 1893-96. The chief object of the expedition which will use the new ship will be a thorough study of the deep parts of the Arctic basin which are covered the year round with an ice crust so thick that the strongest ice breakers can not pierce it.

FLOWERS of the most familiar modern plants have male and female parts—pollen-yielding and seed-forming organs—close together. Lilies, apple-blossoms and buttercups are common examples. But it was not so in the most primitive flowers, some tens of millions of years ago, according to Professor H. Hamshaw Thomas, of the University of Cambridge. These earliest flowering plants kept their sexes carefully segregated, as they still are in some modern species, such as pines and willows. Evidence from fossils and from the study of modern floral structures tends to indicate that the earliest flowers consisted of whorls of structures bearing the reproductive elements, each whorl tipping the end of a branch. Professor Thomas also offered the opinion that flowers are not all derived from one common ancestral type. The common assumption is that they are. If this view is accepted, it will require the very radical revision of many currently accepted ideas of botanical evolution and classification.



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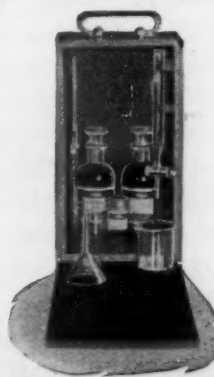
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SCIENCE NEWS

*Science Service, Washington, D. C.*PAPERS PRESENTED AT THE MILWAUKEE
MEETING OF THE AMERICAN PUBLIC
HEALTH ASSOCIATION

BY JANE STAFFORD

Science Service Medical Writer

PUBLIC HEALTH workers are lining up their forces for a fight to the finish on mental illness. Those valiant disease fighters who have brought under control such foes of mankind as smallpox, typhoid fever and diphtheria, laid their plans for the attack on mental sickness, which fills half the hospital beds in the country, at the opening session, on October 5, of the sixty-fourth annual meeting of the American Public Health Association. The drive will start with efforts to promote mental health in children. School physicians and teachers hold the key positions. Mental disease, it is agreed by mental hygienists, is mainly acquired in childhood, according to Dr. A. O. DeWeese, director of health at Kent (Ohio) State Normal College. "It is a family disease in the same sense that tuberculosis was a family disease in that some adult has communicated it to the child by prolonged and repeated exposure during a period of weak resistance." Since it is agreed that mental patterns are laid down in childhood, the prevention of mental diseases becomes a problem of leadership and guidance on the part of psychiatrists in the schools and home.

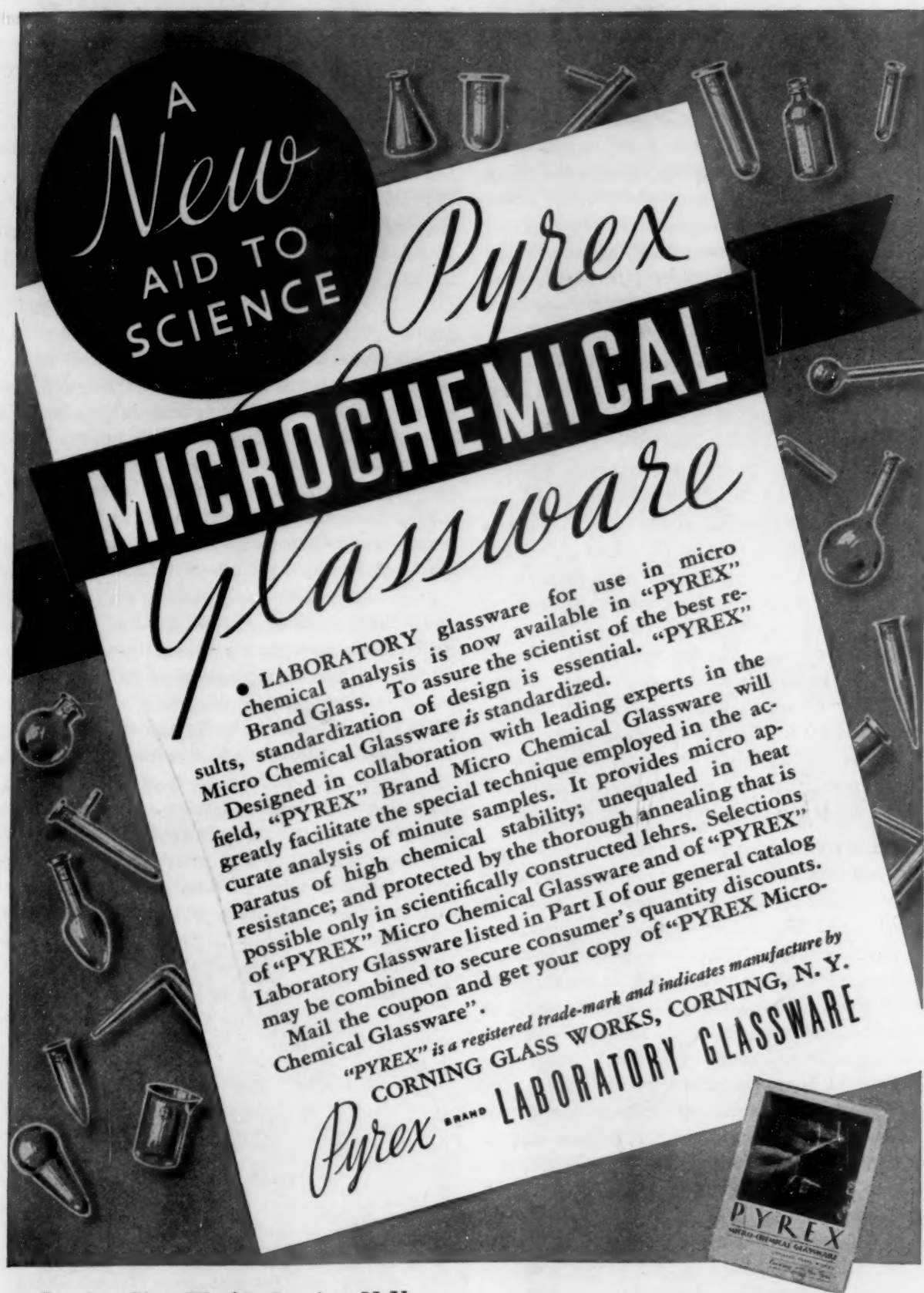
FROM one tenth to one half of mental maladjustments are perhaps preventable, Dr. Frederick L. Patry, psychiatrist of the New York State Education Department, pointed out. Dr. Patry presented a ten-point program for the guidance of health officers and school physicians in their drive to prevent mental disease. One point is that the school physician should pay special attention to every child who is failing at school, who is a misfit in the group, or who is unhappy and protesting his unhappiness with "nerves." "No child wants to fail. Failure means only one thing: that some one has blundered; some one has failed to show the child off to advantage on his own level of ability to succeed." Another of Dr. Patry's ten points related to the importance of the home. This is the most important educational institution of society with respect to mental health, he said. Every effort must be made to see that every child has this part of his birth-right guaranteed. "If the start of life's journey is well prepared, we have little fear of maladjustments later on, although it must be kept in mind that human machinery may go awry at any point along the life span."

A CHANGE in the standard methods of controlling or trying to control scarlet fever epidemics was urged by Dr. John P. Koehler, commissioner of health for Milwaukee. Dr. Koehler based his recommendations on experience during the epidemics of the disease in Milwaukee this year and the year before. Testing school children by the Dick test, to discover those susceptible to the disease, and then making them immune to it by suitable doses of

Dick scarlet fever toxin, is the most effective measure for controlling the disease. Quarantine is less effective, he believes, because the disease is so largely spread by healthy carriers whom it is almost impossible to quarantine, as they may carry the scarlet fever "germs" for many weeks after they have recovered from the disease. "More money for immunization and less for contagious disease hospitals should be the slogan of all progressive health departments," Dr. Koehler said in emphasizing this point. "Scarlet fever quarantine is based more on tradition and expediency than on strict scientific facts." Strict isolation of all children under seven years of age for six weeks during a scarlet fever epidemic not only reduces the number of scarlet fever cases but aids in the control of other childhood diseases. This measure was practised with good results during the recent Milwaukee epidemics. Children under seven years are the most susceptible to contagious diseases and also the most exposed to them.

A NATION-WIDE uniform system of grading all milk produced in the country so that consumers would know the quality of the milk they were using, whether at home or traveling, was urged by Leslie C. Frank, sanitary engineer of the U. S. Public Health Service. Such a system would be of advantage to both consumer and producer. There are in this country each year at least 30 to 50 outbreaks of disease resulting from infected milk, Mr. Frank said. Most people who use milk know that not all milk supplies are safe, but they have no way of distinguishing a safe from an unsafe supply. Milk producers would benefit also from the plan Mr. Frank presented. The problem of the producers is one of overproduction, or of production of more milk in certain areas than can be profitably sold. Price-fixing efforts have failed and curtailing production would be unwise, in Mr. Frank's opinion. From the public health viewpoint, not enough milk is being used in the country as it is. According to Mr. Frank, "The only logical solution of both problems is that consumers and industry members coordinate their efforts in a unified nation-wide program to increase milk consumption to the optimum. This can be done best by increasing the desirability and safety of milk."

DISCOLORED teeth with ugly brown spots that no amount of scrubbing with any kind of tooth paste or powder will polish to shiny whiteness are the unfortunate lot of all the children in certain towns in the United States. Just how much there is in the whole country of this disfiguring, incurable condition, known as mottled enamel, is unknown. A method for determining the extent of the disease, however, has now been developed by Dr. H. Trendley Dean and Elias Elvove, of the U. S. Public Health Service. Mottled enamel is caused by fluorine in the water used for drinking and cooking during the period when the child's permanent teeth are being calcified. It can not be cured, but it can be prevented by using water that




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does not contain harmful amounts of fluorine. As little as one part of fluorine in a million parts of water will probably cause the condition. Practically, prevention is a difficult matter, since it may involve changing the water supply of a community. In many of the communities where the disease is prevalent, especially in the Southwest, the fluorine-containing water is the only water available. At present there are in this country alone more than 300 areas where the condition is prevalent. The areas are distributed among 23 states. There are no figures as to how many American children are afflicted with the condition, but the total number must be quite large, since as many as 90 per cent. are affected in some communities and 100 per cent. in others.

A QUESTION as to the relative importance of prenatal care for the expectant mother was raised by Dr. Margaret Tyler, of the Medical School of Yale University. Obstetrical care at the time the child is born may play by far the greatest part in improving the outcome for the mother, a survey reported by Dr. Tyler indicated. Groups of patients receiving contrasting amounts of care and supervision during pregnancy but attended at childbirth by the same obstetrician were studied. The outcome at labor was strikingly similar for the contrasting groups, revealing no definite superiority on the part of those who had the more extensive care. The better prenataally cared for group was found to include an excess of complications of pregnancy, many of which had apparently prompted the seeking of extra care. This same group revealed an excess of complications of labor, the ratio of which to those in the poor-care group did not appear to have been markedly altered from the ratio noted in pregnancy.

A TEST which shows the approach of lead poisoning before the disease has actually developed was reported by Drs. Carey P. McCord and F. R. Holden and Jan Johnston, of the Industrial Health Conservancy Laboratories, Cincinnati. The test is particularly valuable in protecting industrial workers who are exposed to lead in the course of their work. By means of the test, which is called the basophilic aggregation test, the physician can tell whether or not lead poisoning is the early prospective lot of the individual being examined. "In this test," Dr. McCord explained, "counts are made of embryonic blood cells which in normal persons rarely exceed one per cent. of the total number of red cells in the blood, but which in the case of lead poisoning may amount to much higher percentages, such as 4, 6 or 10 per cent." An extensive lead poisoning epidemic which took place in the automobile industry in 1934 and 1935 provided an opportunity for evaluating the new diagnostic procedure. In this epidemic 8,000 tests were made with results more than 95 per cent. accurate. The epidemic resulted from the use of metallic lead in automobile body production, it was explained. Lead in the form of dust and fumes was inhaled by exposed workers, with the result that many hundreds were injured by this industrial intoxication. The total number of persons affected either with clinical lead poisoning or who evinced evidences of lead absorption is not known for the entire industry, but it has been approximated at 4,000.

A SERIOUS public health problem, pulmonary asbestosis,

has arisen in recent years as a result of the four-fold increase in the manufacture of asbestos products. The health hazards of the asbestos industry were pointed out by Dr. J. Donnelly, of Huntersville, N. C. Lack of protection from the inhalation of asbestos dust has been the cause of the disability of many workers. In an examination of x-ray films of 151 workers in asbestos mills, 52 films showed definite evidence of lung disease. Of the 151 workers, 86 had worked in the industry for periods varying from four to twenty years. In this group were found 51 of the positive cases of asbestosis, a percentage of 59.3. Only one case with positive x-ray evidence of asbestosis had worked in the industry less than four years. The positive cases comprised 34.4 per cent. of the total number of 151. Five films of this series showed a healed tuberculosis with no asbestosis, and three showed a healed tuberculosis complicated by asbestosis. These workers had spent from four to ten years in the industry. There was no evidence that their work had any tendency to re-activate their tuberculosis lesions. Asbestosis is a slowly progressing condition after it is once acquired, even though there has been cessation of exposure to the dust for extended periods of time.

IN rural areas more new cases of tuberculosis develop from contacts with tuberculous persons in schools, factories or other work places than from contacts within the home and family, according to a report by Jean Downes. Miss Downes, working under the Milbank Memorial Fund, investigated the spread of tuberculosis at Cattaraugus County, N. Y. She found that in this region for every case resulting from a family contact there were two in the community as a result of contact outside the family. "Tuberculosis in that rural area has been acquired chiefly through contact in the small centers of life, the family, the factories and other work centers, and the schools. The individual living in the tuberculous family has a definitely higher personal risk of contracting the disease than other individuals in the community, but the spread of serious disease from the tuberculous family into the community at large is probably as great as the spread within the family."

OVER six hundred persons have been supplied by the Philadelphia Serum Exchange with serum for the prevention or treatment of various diseases. How the preventive and curative serums are preserved and distributed through the exchange was described in a report by Dr. Stuart Mudd, of the University of Pennsylvania School of Medicine, and his associates, Joseph Stokes, Jr., Aims C. McGuinness, Earl W. Flosdorf and Harry Eagle. The serum handled by the Philadelphia exchange was obtained from patients recovering from disease and from normal adults. It is frozen and dried by special processes which make it possible to keep it indefinitely. When it is to be used, all that need be done is to introduce sterile distilled water through a syringe and the porous dehydrated material goes quickly into solution. Convalescent measles, scarlatina, chickenpox and mumps serum, and pooled serum from normal adults have been used satisfactorily for protecting persons who have been exposed to these various diseases, Dr. Mudd reported.

Scarlatina convalescent serum has also been used for treatment with most satisfactory results, he said. A point of special interest to public health workers, Dr. Mudd pointed out, is the preservation of serum from diseases like influenza and encephalitis, in which the cause is uncertain. Serum from epidemics in Alaska and Philadelphia, for instance, has been made available for current investigation, and samples have been preserved for comparison with serum from patients in future epidemics.

THE teacher and the physician are the two persons who can contribute the most toward an effective program of school health, according to Dr. J. T. Phair, of Toronto, who spoke at a joint meeting of the American Public Health Association and the American Association of School Physicians. Next after the teacher and physician, in order of importance of their contribution to the school health program, are the psychologist, the physical director, and finally the others such as nurse, dentist and mental hygienist. The teacher should be impressed with the fact that good mental and physical health and the ability to make social adjustments are greater assets to the graduates from our educational system than the greatest possible absorption of the mass of inapplicable information which is generally forced on him. Little can be expected in the way of further improvement in school sanitation until standards scientifically sound are established for the guidance of school designer, administrator and medical officer. "Approximately 2,500,000 children enter the state-operated schools in Canada and the United States for the first time each year," Dr. Phair said. "The majority of them come from homes in which personal health is thought of as an abstract thing that you are born with and die from the lack of, and where community health is considered as the removal of nuisances and an avoidance of the hardship of quarantine."

HOWEVER disappointed the taxpayer may be with the quality of service given him by public officials and employees, he has no cause for complaint against public health workers. Praise for these public servants was given by Dr. W. W. Bauer. "There is a great disillusionment abroad in the land with respect to public service," Dr. Bauer stated. "That this is without foundation for the great majority of public health workers, I am convinced." Ways in which community organizations can be interested in the official health program were discussed by Dr. Bauer, who is director of the Bureau of Health and Public Instruction of the American Medical Association. The program itself must be worthy of interest, aside from publicity techniques for popularizing it. The health official and his whole department must work at their jobs of protecting the public health, if they wish to win the interest and support of community organizations, he continued. Popular appeal, practicability, economy and timeliness were stressed as important qualifications of the health program. As examples of health projects easy to establish because they had these qualifications, he cited infant hygiene, diphtheria and smallpox immunization, and certain types of sanitary work which abolished or mitigated disagreeable nuisances.

ITEMS

SEPTEMBER was a little cooler than normal, taking the country as a whole, a U. S. Weather Bureau survey of the month, just completed, shows. In the central part of the country, September began cool, warmed up considerably during the middle of the month, but was again cool at the close. In most of the East the month was cooler than normal, while in the South and Southeast near-normal temperatures prevailed. In the Northwest, however, it was continuously warm, with temperature departures averaging five to six degrees above average. The month was unusually dry in the lower Ohio Valley and most of Tennessee, while precipitation in much of the Northwest and Far West was seriously deficient. In most of South Dakota, western North Dakota, Montana, and from Idaho westward, September rainfall was less than one fourth of normal, and wide sections reported practically no rain for the month.

ANNOUNCEMENT that the giant 200-inch glass disk from the Corning Glass Works will not be shipped until the middle of December has altered the plans of the U. S. Army Air Corps to use the specially built flat car to transport east a huge airplane wing now under secret construction at the plant of the Douglas Aircraft Co. at Santa Monica, Calif. The glass disk, destined for future use as the world's largest telescope mirror, is sixteen feet in diameter. The chord of the huge airplane wing—the distance from front to back at the widest point—is approximately the same size. Aviation officers at Rockwell Field, Calif., had been investigating the possibility of using the special flat car to bring the huge wing back to Middletown, Pa., for assembly. Because of the delay in shipping the glass disk, the wing will probably have to be shipped by water *via* the Panama Canal, since it will be completed long before December 15.

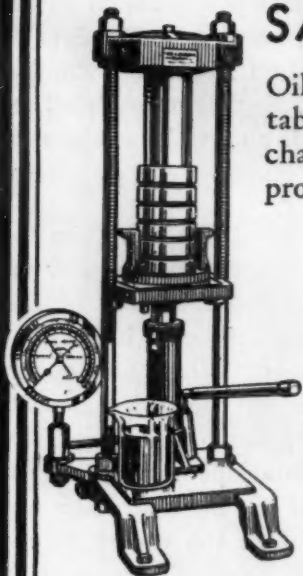
TREES that sprang up from seeds scattered by airplanes are growing to-day in mountain fastnesses where man has never trodden, according to the reports of Hawaiian foresters. Because some areas in the precipitous volcanic mountains are inaccessible for planting by the usual means, the idea of sowing seeds from airplanes, borrowed from the United States Army, was hit upon. At the time they were first scattered, it was impossible to determine whether any of the seeds took root, since the area sown could not be reached on foot. Now, however, foresters report that the trees are visible from a distance, particularly such varieties as the African tulips with their vivid scarlet flowers. This method has been particularly useful in replanting areas on the island of Hawaii devastated by forest fires. According to a report of George McEl-downey, forest supervisor for the Hawaiian Sugar Planters' Association on the island of Oahu, trees of the African tulip, Moreton fig and hutu have been found in the mountains behind Honolulu, growing from plane-scattered seeds. Dr. H. L. Lyon, forester of the Hawaiian Sugar Planters' Association, about ten years ago originated the idea of using surplus seed in such a manner. He made several experimental flights in the Maitland-Hagenberger plane *Bird of Paradise*, first to fly from the continent to Hawaii.

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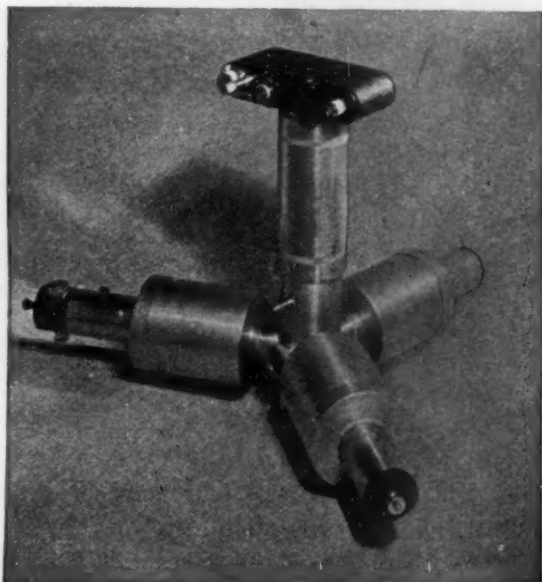


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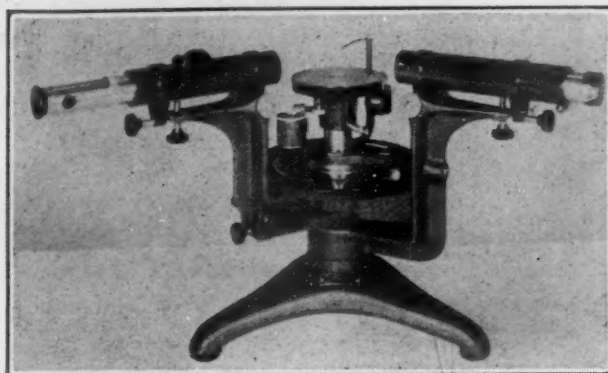
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The prism table is 80mm in diameter and fitted with independent levelling and height adjustment, and has also a rotation independent from the vernier plate. The collimator and telescope have achromatic objectives of 25 mm aperture and 160mm focal length. The slit has a carefully ground and polished nickel silver jaw 6mm long. The entire instrument is finished in a black baked enamel.



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SCIENCE NEWS

*Science Service, Washington, D. C.*TEMPERATURES NEEDED TO EXPLAIN
STAR'S RADIANT ENERGY

UNLESS the interiors of stars are almost entirely made of iron, their internal temperatures must be as much as 1,000,000,000 degrees Centigrade, Dr. T. E. Sterne, astrophysicist of Harvard College Observatory, told the meeting of the Electrochemical Society held in Washington on October 10.

The outside surface of the sun, the hottest matter at which science can get a good look, is by comparison only about 6,000 degrees on the same temperature scale. The estimated outside temperature of other stars ranges from 1,650 degrees for very red stars to 35,000 degrees for those known as Class O.

These new estimates of internal star temperatures, Dr. Sterne pointed out, come from the theories of Professor E. A. Milne, of the University of Oxford. They exceed by a factor of 100 times the previously-held concepts of Sir Arthur Eddington, of the University of Cambridge, that the inside temperatures of ordinary stars were "merely" about 10,000,000 degrees.

Only in the case where a star is very dense, as in the baffling "white dwarf" type like the companion of Sirius, is the extra high temperature not needed, Dr. Sterne indicated. The white dwarfs have an average density 61,000 times as great as water and at their center matter probably weighs as much as five tons to the cubic inch. For such dense stars the theory of Professor Milne yields a central temperature about like the theory of Professor Eddington's—tens of millions instead of billions of degrees.

The staggering problem of internal star temperature is an essential part of one of the most important problems of astrophysics—the question of determining a reasonable mechanism which would create the enormous amount of radiant energy that the stars have been wastefully pouring out into interstellar space for at least 100,000,000 years.

Dr. Sterne indicated that in view of the findings of recent experiments on artificial transmutation of the chemical elements in laboratories, transmutation of elements from one to another within the centers of stars appears to offer the most reasonable explanation of great outpouring of stellar energy.

While the outsides of stars are constantly radiating energy into space, and consequently are not in equilibrium with their surroundings, the interior of stars might present a situation of approximate statistical equilibrium which is essential for a starting point on even the most fragmentary theory of star energy.

At temperatures of billions of degrees transmutations conceivably would be completely reversible with the elements changing from one to another in millionths of a second of time and liberating vast quantities of energy in the process.

Eddington's estimates of 10,000,000 degrees for internal star temperatures would not be sufficient for such

reversible transmutations to be maintained, according to Dr. Sterne. A billion degrees, and more, are needed to explain the energy output, unless the stars consist almost wholly of iron atoms which, theoretically, can not be transmuted into other elements without absorbing—instead of liberating—energy.

SUPER-HARD GLASS MADE IN SUN
FURNACE

A NEW type of "glass" of super-hardness and with high resistance to acids was reported to the recent meeting of the Electrochemical Society by Dr. Willi M. Cohn, of the University of California.

The "glass" is fused transparent zirconium dioxide (ZrO_2) having a slightly yellowish tinge. It was made by melting compressed sticks of ZrO_2 in a special sun furnace which concentrates sunlight with a large mirror and quickly raises the temperature to 3,000 degrees on the Kelvin temperature scale. Three thousand degrees Kelvin corresponds to more than 2,700 degrees Centigrade.

The zirconia glass can be heated to incandescence and dipped into cold water without cracking, is highly resistant to acids and ranks next to carborundum in hardness.

The sun furnace, with which the zirconium dioxide sticks were melted and fused, is a new step in obtaining high temperatures, Dr. Cohn reported. While it is difficult to determine exactly what temperatures such sun furnaces will create, the theoretical limit is the temperature of the sun's surface at 6,000 degrees Kelvin, or 10,000 degrees Fahrenheit.

The sun furnace, which Dr. Cohn obtained from the Zeiss Works in Jena, Germany, consists essentially of a large plane mirror which follows the course of the sun and reflects the sunlight onto a 100-inch diameter searchlight mirror with a silver backing. The heating takes place at the focus of the searchlight mirror. Arrangement is made for observation of the samples while being heated. If necessary the sample can be placed in a transparent container and its reactions studied in a reducing or neutral atmosphere or in a vacuum.

Dr. Cohn reports that "although this sun furnace means a step in advance as far as obtaining higher temperatures for exact work is concerned, it does not, however, enable us as yet to extend the upper limits of high-temperature research by more than one or two magnitudes over the older limits. Higher temperatures, in an oxidizing atmosphere, than those possible in the sun furnace may have been attained in the past, but, if so, it was for a mere fraction of a second and not for any length of time suitable for the fusion of relatively large masses of material."

GEOGRAPHIC STOCK-TAKING

GEOGRAPHIC stock-taking, not merely by nation, but by continent or even world, was urged by Dr. Isaiah Bowman, president of the Johns Hopkins University, at the

second general assembly of the Pan American Institute of Geography and History in Washington on October 9.

A new "millionth" map—that is, on a scale of one to a million—of Hispanic America, already compiled by the American Geographical Society and to be ready for the engraver by the end of 1935, was called one of the largest and probably most fruitful and practical co-operative undertakings in science.

This map makes possible a new cooperative enterprise in cartography—a new period of geographic science when continent-wide data on climate, water resources, mineral deposits, soils, rock structure, plant and animal life, human culture and population past and present, can determine national policies.

Stressing the need of cooperation, Dr. Bowman said that map-making is no longer an individual undertaking, as it once was, but a joint one, since the requirements and standards are high. The new "millionth" map of Spanish America would have taken a single individual 150 years of full maturity, skill and strength for the work. Begun in 1920, ten men per year have worked upon it, not counting cooperation of hundreds of persons and all the governments of Pan America.

The project of a new "millionth" map of the world advanced since 1909, and now covering nearly one fourth of the land surface of the globe, had to become an international undertaking.

THE VOLCANIC ZONE IN MEXICO

AN "important accident" of geography has drawn the boundary between North America and Central America right through Mexico. So scientists attending the Pan American Institute of Geography and History, meeting in Washington on October 11, were told by the director of the institute, Engineer Pedro C. Sánchez, of Mexico.

Nature's line crosses Mexico along the nineteenth parallel of latitude, which is about the region of Mexico City. South of the line is a land of volcanoes and earthquakes, characteristically Central American. North of the line is stable North America.

Dr. Sánchez described geological studies showing that the boundary line, called the volcanic zone, is not merely superficial, but is borne out by conditions deep under the earth.

Dr. Sánchez blamed ancient erosion as the probable cause of Central America's earth-tremblings and smokings. Erosion of rocks and soil in the region, he explained, has created a deficiency of mass in the earth's crust. This was and is serious enough to disturb equilibrium of the earth. Meanwhile to the north an excess of mass exists. Deep within the earth the internal semi-plastic material tends to shift from north to south, endeavoring to restore balance. The earth's crust is agitated into earthquakes, and when a fault, or displacement of rock strata, is present volcanic action appears in full intensity.

STARFISH DYED BLUE TO TRACE THEIR MOVEMENTS

BLUE starfish are staring startled oystermen in the face, along the Long Island Sound oyster beds. The orthodox

color for starfish in those waters is pink. The oystermen, however, are being told what it is all about, by the U. S. Bureau of Fisheries. The starfish have been dyed blue for the same reason that migrating birds have aluminum bands fastened about their legs—to tell where they came from, and how far they have traveled.

Starfish, as is well known, are among the worst enemies oysters have. They fold themselves over the oysters' shells, smother them until they open up, and then devour them. They devastate oyster beds by the square mile in this way.

During the recent session of the Congress, funds for the scientific investigation of starfish and other enemies of oysters were appropriated, and research begun at several points. One of the things Victor Loosanoff, of the bureau, wanted to learn was the rate of starfish travel—for starfish can move, despite their not-very-motile appearance.

But it proved impossible to fasten on them the customary types of tags or bands. They could wriggle out of any kind of knot, and if a tag were stapled right through an arm the starfish calmly shed the arm and grew another. Starfish can do that kind of thing pretty easily. But a starfish can not get outside its own hide so easily, so the scheme was finally hit upon of dyeing them a conspicuous color and then turning them loose in thousands. Nile blue, a powerful anilin dye, proved well adapted for the purpose. One ounce of the dry powder provides enough solution to stain more than 25,000 starfish blue. The process is very simple. The captured stars are dumped into the dye-vats for about a minute, held on deck for an hour, and pushed back into the sea. It costs far less, in both money and time, than any other method of "tagging" living specimens.

Oystermen and all other persons finding blue starfish are requested to write to the U. S. Bureau of Fisheries Laboratory at Milford, Conn., stating the exact location, depth of water and time of capture.

SANDALWOOD, HAWAII'S MOST VALUABLE TREE

SANDALWOOD, theme of a thousand romances and poems of early commerce, is being groomed for a comeback in the forests of Hawaii. It once existed there in great quantities, but over-exploitation 125 years ago by an alliance of traders and native potentates almost wiped it out.

The forests were devastated at that time because of the high prices that could be secured in China for this sweet-scented wood. They promise to be reestablished because that price still maintains.

C. S. Judd, territorial forester, some years ago secured from Mysore, India, seeds of what is held to be the most valuable species of sandalwood. He planted these seeds on a ridge in the suburbs of Honolulu and they grew abundantly. To-day there are some 1,500 three-year-old trees on this ridge. They are bearing all the seed that is needed for nursery use. Aside from these, an old sandalwood tree is occasionally found in some remote mountain canyon.

Mr. Judd is developing much nursery stock, based on

this seed supply and with the aid of C.C.C. men as a labor supply. He is finding, however, that sandalwood trees present certain peculiar problems in their propagation. A seed planted in a pot will sprout and grow normally for six months and then, unless it is given a peculiar variety of aid, it will languish and die. The plant is a semi-parasite. Its roots fasten themselves on the roots of neighboring plants and steal a considerable portion of their nourishment from them. Unless there are proper host plants, they will not survive.

In the pots at the nurseries in Hawaii ironwood seeds are planted with the sandalwood. When the little plants are set out in the open, the ironwood plants go along. Thus they continue to contribute to the support of this valuable but somewhat lazy tree. In its native state the sandalwood always grows among other trees and helps itself to aid from their roots, as a partial parasite. On the ridge that overlooks Honolulu where 1,500 young trees are growing vigorously they stand among lantana bushes, members of the verbena family.

Sandalwood trees grow rather rapidly. They are of some value at the age of 25 years. It is the heart of the tree, however, that is most precious, and heart-wood is not likely to develop greatly until the tree is 40 or 50 years old. Since the present plantings are chiefly in territorial forests, however, the profits do not need to be immediate to make the enterprise sound.

CONTROL OF MOSQUITOES IN NEW JERSEY

NEW JERSEY'S mosquito fighting legions look back with more than ordinary satisfaction upon the results of the season's campaign now ending. They have proved their new type larva-killing compound to be able not only to kill "wigglers" in their pools and puddles, but to bring to grief whole squadrons of adult mosquitoes actually on the wing. It can also render any given area untenable to the pests for periods of from two to four hours, just as some of the war-chemicals used in human conflict can make an area of field or forest impossible of occupation by enemy troops.

The New Jersey larvacide is a mixture of light petroleum oil and pyrethrin, an extract from the pyrethrum flowers long used in the making of Dalmatian insect powder. The addition of this active principle to the oil so increased its effectiveness that now four or five gallons will produce as large a killing film as used to be obtained from 35 to 40 gallons. With the addition of a little soap, a perfect emulsion can be made with ten or twelve times its bulk of water.

It was developed at the New Jersey Experiment Station. Although it is protected by a patent against commercial monopoly, no restriction is placed on its use, and all inquiries are being answered by the Department of Entomology.

To render land areas untenable by mosquitoes, a power sprayer is used, producing a fine mist of the emulsified larvacide. This spreads over earth and vegetation and clings closely for several hours, making the neighborhood unbearable for mosquitoes, but entirely comfortable for man and his domestic animals. It can also be applied with a hand sprayer, to repel mosquitoes from porches

and other unscreened haunts of man. For use over water, sprayers mounted on airplanes are employed.

The new larvacide was found to meet four of the five requirements of an ideal larvacide which Dr. Thomas J. Headlee, entomologist at the experiment station and leader in the long fight against the "Jersey Pest," had set forth several years before. It quickly destroys all mosquito larvae with which it comes in contact, it is non-poisonous to higher animals and man, it is not injurious to water plants, and it is cheap enough to render its use practicable. It fails to meet only the fifth of Dr. Headlee's requirements: It does not remain effective throughout the season. However, attention is now being devoted to improving the lasting qualities of the larvacidal film.

ITEMS

THE search for better types of anti-aircraft targets has long been a pressing problem among the great powers of the world. U. S. S. R., with its current emphasis on gliders and parachute jumping, has been reported by its news agency Tass to have developed a system whereby a train of gliders are towed aloft by an airplane and then cut loose one by one to be shot at by anti-aircraft guns on the ground. The glider pilots set the course of the gliders and then jump safely to the ground. The new British system of using high-speed airplanes operated by radio control, while more costly, would appear to bring much more reality into the target practise.

"ROCKETS" of luminous bacteria, that shine with cold light of their own making, were shown in a unique bioluminescent exposition held in Vienna recently, under the direction of the biologist, Professor Hans Molisch. The "rockets" were set off in spiral glass tubes filled with a suspension of luminous bacteria in a nutrient fluid. The ends of the tube were sealed shut, with enough spare space to accommodate a good-sized bubble of air. When the tube was inverted, the bubble rose to the upper end, disturbing the bacteria and exciting them to luminescence. Recently, as a "stunt," one of Professor Molisch's students illuminated the great hall in the Paris Oceanographic Institute with a battery of "bacterial lamps." The light was faint, but sufficient to see by. Over forty species of luminous bacteria are known to science, shining in all colors from deep green to bright yellow. Most of them are found on marine fish.

NEON lamps, running on the same principle as the red-glowing American street signs, have proved far more satisfactory than the conventional incandescent lamps for use in forcing plants and flowers in the experimental greenhouses of the Agricultural College of Wageningen, The Netherlands. They are more economical, partly because they convert a far greater proportion of the electric current into light and waste less as heat, and partly also because their light is rich in the yellow and red wave-lengths that are most stimulating to the action of chlorophyll in the green leaves. Among the plants so far tested have been cucumbers, strawberries, begonias and a number of other flowers. In some of the experiments an extra supply of carbon dioxide gas was artificially administered.

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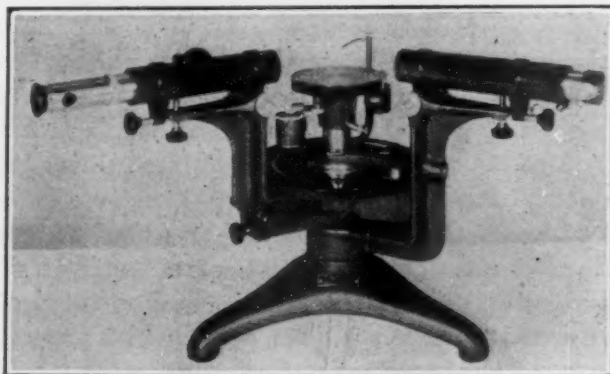
- (1) Exhibits which illustrate scientific studies, phenomena or progress.
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SCIENCE NEWS

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DISTANT NEBULAE

LIGHT signals coming from the outposts of the universe take 500 million years to reach the telescopes of astronomers on earth, Dr. Edwin P. Hubble, of Mount Wilson Observatory, said in the first of a series of lectures delivered at Yale University. Light with its super-speed of about 186,000 miles a second, he added, travels nearly six million million miles a year.

The outposts of the universe are the faintest nebulae, or stellar systems, detectable with the giant telescopes now in use. The outposts mark the surface of an imaginary sphere in space which is called the observable region.

As telescopes have become more powerful in their light-gathering ability the observable region of space has become larger. The efforts of astronomers to study larger and larger regions might be compared to a man holding an electric light in a fog. Only a limited region of the fog is illuminated and "observable" for a given brilliance of light. To see a larger region a stronger light must be used.

A stronger light would be a larger telescope in this analogy, not because it shines out in space and illuminates more of it, but because it has a greater ability to gather what light exists in space and focus it on photographic plates.

Within the "observable" region of space, Dr. Hubble indicated, it is now probable that there exist some 100 million nebulae like the one of which the sun and earth are tiny parts. A study of the distribution of these nebulae shows that on the average they are two million light years apart. If one could mentally shrink each nebula (which is 10,000 light years in diameter) to the size of a tennis ball the next nearest nebula, on the average, would be about fifty feet away.

The observable region of space so far studied, Dr. Hubble said, has been found to be what astronomers call homogeneous and isotropic. That means simply that it is pretty much the same everywhere and in all directions.

A major problem of astronomy is to determine whether the vast region of the universe now observable with telescopes is a fair sample of remaining space. If it is, the characteristics that have already been found would apply to the universe in its entirety. The new 200-inch diameter telescope being built for the California Institute of Technology will go far in answering this important question.

THEORY OF COSMIC RADIATION

IN an article copyrighted by Science Service Dr. W. E. Danforth asks whether cosmic rays are a sort of super x-ray, i.e., very high-powered "bullets of light," or are they particles of matter bearing electrical charges? Until recent years the former possibility was almost universally favored. The recent journeys of scientists, bearing cosmic ray detectors to various parts of the world and to mountain tops, however, have proved that these projectiles, which pelt down upon us from interstellar

space, are affected by the earth's magnetic field. Therefore they must consist, at least in part, of electrically charged particles such as electrons or protons.

A complete theory of cosmic rays, however, has a host of facts to explain. A theory must, for instance, result in a mathematical formula from which the number of cosmic rays at any altitude can be calculated. The appeal to physicists of the "super x-ray" or "photon" theory lay in its success in giving the correct altitude formula. But now that a large part of the cosmic radiation is known to be of electrically charged nature, this success of the photon theory appears illusory.

A new form of charged particle theory, which enables one to explain all of the major known facts about cosmic rays, including the precise way in which their intensity varies with altitude, is propounded in the current issue of *The Physical Review* by Dr. W. F. G. Swann, of the Bartol Research Foundation, at Swarthmore, Pa.

Perhaps the boldest aspect of this theory is the supposition that the original (or "primary") rays continue right through our atmosphere in undiminished numbers until they bury themselves in the earth. But what, the reader may ask, about the fact that on a mountain top there are many times as many rays as at sea level? To this question Dr. Swann replies that nearly all of the rays which affect cosmic ray detectors are not the original primary cosmic rays, but are other electrically charged particles knocked out of atoms by the primary rays as the latter traverse the atmosphere. These secondary rays fly forward with practically the same direction as the primary which produces them. Some energy is lost by the primary every time it produces a secondary.

One of the cornerstones of the theory is the supposition that the number of secondaries produced in a given distance is in direct proportion to the energy of the primary ray. Strangely enough, the theory permits a primary charged particle to be changed into something else, e.g., a bullet of light, once it is within the atmosphere.

THE STRATOSPHERE FLIGHT

OFFICERS of the National Geographic Society are anxiously scanning the daily weather maps hoping for favorable conditions for the take-off of the stratosphere balloon *Explorer II* from Rapid City, S. D.

The expedition, sponsored by the society and the Army Air Corps, needs a "high" area of barometric pressure extending to the east and southeast of the take-off site. The technique is to allow the high area to get ahead of the balloon flight and then ride the "tail" of the high eastward.

The gondola and its equipment will be a ton lighter than in the flight originally scheduled for last summer. The 2,000-pound cosmic ray apparatus of Professor Robert A. Millikan will not be carried.

Other changes in the flight include a new design for ripping the balloon fabric in an emergency. No rip

panel will be employed, since previous failures of the upper balloon fabric have been traced to the possible weakness inherent in rip panel design.

Instead a steel cable will be securely fastened to the outer surface of the balloon near the catenary band. This cable extends to the top of the balloon and then goes down inside through a special, strongly-reinforced hole less than a half inch across. Inside the balloon the steel cable joins a stout rope which comes down and out through the bottom of the balloon bag near the gondola. One sharp jerk on this rope will rip the whole upper fabric and allow an emergency, rapid descent.

The steel cable system is not a new technique but has already been used in airship construction. It is believed, however, that it is the first time it has been applied to a balloon.

Cold weather and snow have been experienced recently at the take-off site. A survey of the weather records of the site for the last 33 years discloses that in October on the average there should occur two perfect days for an ascension, and two others classed as nearly perfect.

NOISE RATING ON MOTOR VEHICLES

On and after August 1, 1936, all new motorcycles, trucks and private motor cars in Great Britain should be made to pass a noise test before being sold. This is the recommendation of the committee on motor vehicle noise recently appointed by the Minister of Transport, the Hon. Leslie Hore-Belisha.

After a year of study the committee gave the private motor car, except when going over 50 miles an hour, a clean bill of "health" as far as noise is concerned. "Except when running at excessive rates of speed the present-day motor car can not be regarded as unduly noisy."

Membership of the committee included such investigators on sound as Sir Henry Fowler and Drs. G. W. C. Kaye and H. J. Gough, of the National Physical Laboratory.

Realizing the impossibility of studying old and used motor cars in varying degrees of degeneration the committee concentrated its noise studies on new vehicles as delivered from the factory.

Motocycles, much more commonly used in England than in America, were found to be the greatest offenders in regard to noise. New machines operating on level ground at maximum speed produced a loudness rated at 105 decibels, equivalent to the noise of a busy boiler shop. Even at 30 miles an hour many of them had an unenviable noise rating of 95 decibels—equal to the noise of a riveting machine or an elevated train.

At 30 miles an hour, for comparison, a private motor car was rated at only 85 decibels. Besides clearing the private motor car as a noise menace the committee's findings included: "A number of sports cars are at present too noisy but could clearly be brought to the more acceptable level of the remainder of this type. Except at moderate, steady speeds many motorcycles are in general too noisy. It is evident that the high performance of such machines has outpaced the art of quieting them. Certain commercial vehicles are somewhat noisy but could probably be improved in many cases by attention to en-

gine and gear noises and, in a less degree, to exhaust noise."

FOSSILS IN NEW MEXICO

THE fossilized skull of a shark which inhabited the fresh water streams of New Mexico in the Paleozoic geologic era of about 225,000,000 years ago, has been found in New Mexico by a party of University of California scientists. Thirteen skulls of amphibians of the same era, and numerous fragments of as yet unclassified reptiles, were also uncovered.

The skull of the shark was about six inches wide and a foot long. This animal was probably four feet in length. It had teeth not more than a quarter inch in length, and large gill arches.

The largest of the amphibian skulls was ten inches in length and eight inches wide. The body of this animal was about four feet long. Its entire bodily structure was thin and delicate. A peculiar feature was the existence of four spines, which projected back over its neck. In appearance it resembled somewhat the giant salamander found in Japan to-day.

These remains were found embedded in the side of a hill near the head of a dry stream bed, the Arroyo de Agua, which is about sixty miles northeast of the City of Santa Fe. S. P. Welles, laboratory assistant in the museum of paleontology, who was in charge of the party, says that this area was undoubtedly a flood plain, with streams and lakes, somewhat similar to that of the lower Mississippi to-day.

The fossils were found deposited in layers or beds. These discoveries are the first of their kind to be made in New Mexico. Beds of these animals have been found in Texas, and it is now hoped to correlate these with the New Mexico deposits. If it is possible to do this, it will facilitate the study of these animals and assist paleontologists to trace their gradual evolution. Mr. Welles was accompanied on the trip by R. E. Moore, D. M. Taylor, B. B. Wilder, J. B. Johnson and Alfred Oakley, all of whom are students in the university.

COLORS USED TO ATTRACT INSECTS

MANY insects have favorite colors, just as human beings do, and these preferences are being used to lure crop pests to their destruction in a device invented by two University of California entomologists, Professor W. B. Herms and J. K. Ellsworth.

The device consists of a lamp surrounded by a cage of electrically charged wires to kill the insects when they make contact. The lamp, instead of shining with ordinary white light, is given the color favored by the particular destructive insect species it is desired to eliminate. Thus, light blue is the color most attractive to grape leafhoppers and artichoke plume moths, both of them costly unwanted guests in California vineyard and truck regions. Light blue therefore is the glow-tube that lures these pests to electrocution on the wires of the Herms-Ellsworth "Monolite."

The Herms-Ellsworth invention has been of especial value to artichoke growers. The whole commercial artichoke crop of the United States is raised in five California

counties, and the plume moth had been destroying 25 per cent. of the heads. Arsenical sprays, effective protection for some crops, could not be used, because there is no way of washing the poisonous residue out of the heads, and regulations of the U. S. Food and Drug Administration forbid the sale of poison-bearing vegetables.

Installation of "Monolites" in the artichoke fields, one to an acre, cost about \$30 an acre, and have reduced the losses due to plume moth infestation from the old figure of 25 per cent. to three per cent. Incidentally, the reputation of artichokes as an exclusively aristocratic vegetable is scotched by its sales record. Half the American crop is sold from pushcarts on New York's lower East Side.

AGRICULTURAL PRODUCTS IN INDUSTRY

WHILE potato growers have been making "hot news" of their wishes for smaller crops and larger profits, despite an apparent reluctance on the part of the AAA, chemical industry is looking forward to a time when a controlled agriculture will be "adjusting" its production in the opposite direction, in order to feed factories that will be even hungrier for corn and cotton than pigs and people are.

A glimpse of this coming alliance between industry and agriculture was given at Cornell University in an address by L. F. Livingston, president of the American Society of Agricultural Engineers. Speaking of the AAA program, Mr. Livingston said, "It was a situation without precedent, yet such was the emergency that something of the sort was mandatory to check the economic collapse of one-half the people."

But the emergency phase of crop reduction to prevent ruinously low prices for farm products is already passing, he continued. The tide is setting the other way, thanks largely to the need of industrial plants for raw materials from the land, to be worked up into manufactured goods through the processes of organic chemistry. And new chemical inventions now in the experimental stage will increase this demand many fold, doing all sorts of things, from building roads out of cotton to making "dry ice" out of by-products of the industrial fermentation of corn.

Even now, more than ten per cent. of the corn crop has as its market the factory, Mr. Livingston said, and "uses for corn are being urged that, if adopted, would consume the entire present crop without leaving one ear for one Iowa hog."

Scientific research, the speaker indicated, is the key to the chemical hook-up between industry and the farm of the future. The great industrial firms are bringing their research resources to bear on farm problems, joining forces with the research work of federal and state governments, which have long been in the field. The industrialists are doing this because they realize that the farmer is not only a prime source of raw materials for their plants, but also because it has become inescapably evident that the great farm market is indispensable to a stable industrial prosperity. "We are in the early dawn of a new golden era in agriculture. The first signs of that dawn are already streaking the sky."

ITEMS

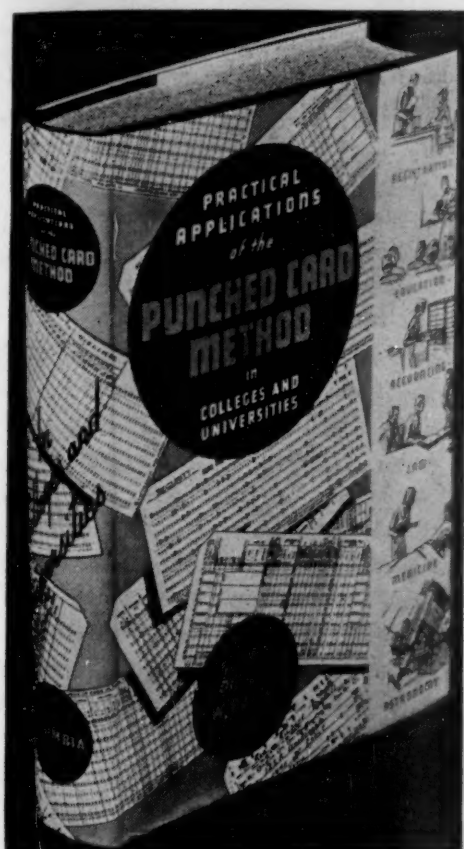
MONTANA'S earthquake, which caused considerable damage in Helena and was felt in other cities, apparently was caused by a different fault, or slipping rock-flaw, than the one which started the more severe shock that rocked the state ten years ago, U. S. Coast and Geodetic Survey seismologists stated after examining wire reports transmitted through Science Service. As nearly as they could locate it by preliminary calculations, the epicenter of the present quake is from thirty to fifty miles farther west than that of the earthquake of June 27-28, 1925.

DRY weather has worked both good and ill to the farmers. It has enabled the corn-picking season to get off to a good start in some localities, notably in the Northwest and the northern prairie areas. But it has also intensified the autumn drought that had already handicapped next year's crop severely, by delaying fall plowing and by preventing the sprouting of seed grain already in the ground.

THE second largest auditorium in the country, which will seat 14,000, is nearing completion in Kansas City. The largest is the famous Atlantic City structure. The new building tested the skill of engineers, for it encloses a vast space 225 by 190 feet that is unobstructed by a single vertical column. Two main steel roof trusses 226 feet long solved the problem. The auditorium, costing \$4,500,000, is only one notable feature of a building occupying an entire block, *Engineering News-Record* reports. Under the same roof are a 3,000-seat theater and four acres of exhibit space.

THE Royal Danish Serum Institute, at Copenhagen, will become a sort of international clearing house for serums used in treating or preventing disease, as a result of action taken at Geneva by the eleventh Congress of Biological Standardization held in connection with the League of Nations Hygiene Congress. The Danish Institute has been appointed the international center for preparation and standardization of serum for such diseases as dysentery, lockjaw, diphtheria, pneumonia and wound fever. London will similarly become the international center for vitamins, insulin and the sex hormones. International standards for the preparation and composition of twenty-five of the medicaments to be distributed from Copenhagen and London have been agreed on by the Congress of Hygiene.

FOUR-LANE roads are active death traps and at least two states are taking steps against them. Accident frequency records on Indiana's four-lane road that skirts Lake Michigan has caused that state to announce that it will build no more such wide roads without a dividing parkway. At the same time, New Jersey is planning to split eight miles of the Brunswick pike in the middle and slide two lanes of the concrete pavement far enough to one side to provide for a separating parkway. "The cost will be \$50,000 per mile for eight miles, and this investment is made purely for safety—no more travel space is added," says the *Engineering News-Record* in reporting the change of thought toward the highway.



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SCIENCE NEWS

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THE WORK OF PROFESSOR SPEMANN

PROBING experimentally into the minute beginnings of life in its embryonic stages, a methodical German investigator discovered there cells that act as leaders, showing the way for the cells around them to develop into brain, spinal cord and other parts of the tiny structure that eventually grows into a man or a woman. Because of that discovery, Professor Hans Spemann, of Freiburg, has become the Nobel laureate in medicine for 1935.

American scientists learning of the award agreed that Professor Spemann is one of the great world leaders in the particular branch of medicine known as experimental embryology. Although he is not the first to study embryology by the experimental method, he was one of the first to become dissatisfied with merely watching the embryo grow, in an effort to learn the secrets of how this tiny structure developed into a baby cat or dog or child. So he began experimenting with the growing embryo.

Among other experiments, he transplanted some of the leader cells into another fertilized egg to see what would happen. In this way it was discovered that a spinal cord, for example, could be made to develop where one ordinarily would not have been found. The leader cells that stimulated development of the spinal cord continue to stimulate surrounding cells to develop into a spinal cord, even if the leaders are removed from their original location and placed elsewhere in the tiny embryo.

These leader cells are known by various names, such as activators or inductors. At first they were thought to influence surrounding cells of the embryo by an abstract process called activation. Further research showed, however, that the effect is one of chemical stimulus. The same effect can be produced by the leader cells after they have been killed by heat as when they are alive and growing. The chemicals which make up the cells have this power to stimulate other cells.

Professor Spemann is internationally known not only for his own discoveries, but for the school of experimental embryology which he has built up in his laboratories. Among his followers in the path of science is one of his three sons, Dr. Fritz Spemann, who is teaching biology at Frankfurt-on-the-Main. A daughter, Mrs. Margaret Cloos, is the wife of Dr. Ernst Cloos, member of the faculty of geology at the Johns Hopkins University.

CAUSE OF THE HELENA EARTHQUAKES

GROWING pains of the comparatively young mountains around Helena, Mont., are responsible for the scores of earthquakes that have shaken and damaged recently the region in central Montana where the Missouri River begins to gather water.

Earthquakes are the price paid by the crust of the earth for its evolution and progress. And in that sense the Rocky Mountain region and the Pacific Coast, because they are younger geologically, are more progressive and likely to give man and his buildings jolts from time to time.

The major shock, of October 19, occurred 70 miles north of Helena in the Little Belt Mountains, the range northeast of that city. Not particularly unusual are the scores of minor shocks that are reminding inhabitants unpleasantly of the big shake. More unusual was the previous Saturday's foreshock, the physical premonition of the major tremor to come.

Scientific shock troops are on the scene of the disaster and have taken up a position in the basement of Helena's federal building. Rushing from California by fast motor truck, Franklin P. Ulrich, seismologist of the U. S. Coast and Geodetic Survey, brought two instruments and set them up to catch the dying tremors of the quake. Late on Monday night an accelerograph and a vibration meter began writing their wavy records in order that the scientists may learn more about how the tremors occur. Passing through a snowstorm in the dash to Helena from the coast, Dr. Ulrich's truck had a minor skidding accident and U. S. Forest Service officials gave aid in getting the seismological instruments to Helena.

Many permanent seismographs miles away from Montana wrote with their pen and photographic fingers the story of the quake as telegraphed by vibrations of the earth itself. At Pasadena, St. Louis, Washington, Chicago, Tucson, Ukiah and elsewhere, as well as at Bozeman, Mont., closest seismograph to the quake, scientists read the records, turned them into code and then telegraphed them to Science Service, where the information was relayed to the U. S. Coast and Geodetic Survey. In this way the exact location of the center of the quake was more accurately determined in Washington than it could be in Montana. The fault or rock cleavage in the mountains that slipped and thus set up the vibration may not be found. The actual slippage of the rocks probably occurred deep in the earth and in this quake probably did not come to the surface of the ground as it sometimes does.

Montana's other important quake of recent years occurred in 1925 and was centered in the region of Lombard, south of Helena and more near the head of the same valley. At that time geological investigations caused the issuance in government reports of warnings that other fractures in the mountains were probably carrying unrelieved strains that would probably cause future earthquakes.

Earliest record of an earthquake in the region was brought back by the famous Lewis and Clark expedition, one of the white man's first penetrations into Montana. One day in 1805 an earthquake was felt and sounds like distant artillery fire or thunder were heard. In 1883 the Gallatin Valley region had strong shocks, but no damage was done because there were few inhabitants.

U. S. Coast and Geodetic Survey seismologists over the week-end sent 500 questionnaires to postmasters and leading citizens in a wide area around Helena, asking them to give the government the benefit of their earthquake experiences. This is expected to supplement the record of

instruments. The government seismologists are of the opinion that Saturday's major shock was not really as strong as the 1925 Montana quake, but that it was more localized. They rate it 8 or 9 on the earthquake intensity scale with 10 a really bad quake.

Builders and architects of the region should take a lesson from the earthquake, seismologists warn. Buildings for a very few dollars extra construction cost can be made to withstand severe earthquakes. The difficulty has been in the past that few took earthquake risks seriously until the earth began to shake.

TIDE IN ROCKS AT PITTSBURGH

PITTSBURGH is rising and falling from 13 to 23 inches each day, according to measurements made at the research laboratories of the Gulf Refining Company in that city.

Dr. Paul Foote, director of the laboratories, told members of the National Research Council's industrial tour for banking and business executives that long-time measures of the force of gravity showed the startling effect of land rise and fall due to moon tides in the solid crust of the earth.

Such gravity measurements, Dr. Foote pointed out, are necessary in geophysical oil prospecting and are widely used by field parties to detect oil deposits thousands of feet below the surface. The extremely sensitive gravity apparatus is constantly being checked and tested in the laboratory and from these continuous records Pittsburgh's rise and fall each day is disclosed.

The sensitivity of the equipment is such that forces equal to only one ten-millionth of gravity are detectable. This is about like saying that if a fireman on a 500,000-pound locomotive threw off a piece of coal weighing only one quarter of a pound the apparatus could detect the weight difference.

The importance of geophysical prospecting, by which geophysicists discover oil wells without making costly test drills, lies in a reduction of wasteful chances. In the Texas Gulf Coast region, where oil is plentiful, there is but one chance in 1,000 of hitting oil by simply sinking a well. By the geophysical method, chances are now lowered to only one in ten or even less.

Coupled with the sensitive gravity measurements are magnetic and earth-wave reflection tests. The magnetic measurements determine the minute changes in the force of the earth's magnetism due to different layers of rock below the surface. The magnetic materials are in the basic levels, and oil-bearing rocks are found above them. Thus if the depth of the magnetic layers can be determined, the prospector-scientists know the maximum depth they will have to drill. In this way the search is narrowed.

Tremor measurements are taken also on earthquake wave apparatus, the seismograph. Small charges of dynamite are set off which set up earth tremors. Some come direct to the recording instruments set up along the earth's surface. Others, however, go downward and are reflected back upward off underlying layers and indicate the presence of various types of rock strata which may contain oil.

Linking the three methods together—gravity, magnetic and man-made earthquake measurements—mountain ranges which lie 5,000 feet below the surface have been discovered. The Amarillo Mountains in Texas are typical of these regions, which lay hidden below the earth's surface until disclosed by geophysical prospecting. Above the buried mountains lie the oil-bearing sands and salt domes of the great Texas oil field.

A NEW MAGNETIC ALLOY FOR LOUD-SPEAKERS

A NEW magnetic alloy, whose permanent magnetism is so powerful that it will lift sixty times its own weight, was shown at the laboratories of the General Electric Company at Schenectady, on the first stop of the Tour of Industries being sponsored by the engineering division of the National Research Council, for business and banking executives.

The purpose of the tour is to emphasize the importance of scientific research for industry, not only in developing new products and better ways of making old ones, but also to replace testimonials and high-pressure selling, in the court of consumer acceptance, with scientific truth and tested realities, according to Dr. Maurice Holland, director of the engineering division of the National Research Council, who organized the tour.

The fifty invited leaders of business and finance are visiting six of the leading industrial laboratories as representatives of more than 1,600 similar research centers throughout the nation, which spend \$750,000 a day for scientific industrial research.

The new magnetic alloy shown to the visitors at the General Electric laboratories is made of aluminum, cobalt, nickel and iron, and will have important applications in the radio industry for the construction of high-quality radio loudspeakers at low cost.

Present dynamic loudspeakers, said W. E. Ruder, of the research laboratory, in describing the new development, require strong magnetic fields obtained by use of electromagnets. The new permanent magnetic alloy will replace these more costly electromagnets. Illustrative of the unforeseen developments possible through scientific research, Dr. Ruder pointed out, is the fact that the new alloy was not originally developed for its magnetic qualities. It was made to serve as a heat-resisting alloy which would not deteriorate at high temperatures.

In Japan, on the other side of the world, Professor T. Mishima, of Imperial University, Tokyo, discovered the magnetic properties of a somewhat similar alloy. When the Japanese research was made known, the American laboratory needed only the development of a heat-treating process which would bring out the full magnetic properties of the alloy. The new material is not available for fabrication from standard bars but must be cast in the required shapes and finished by grinding.

FACTORS IN THE DEVELOPMENT OF CATARACT

ULTRA-VIOLET rays, heat and calcium (lime) salts are three interrelated factors in the production of cataract, Dr. Janet Howell Clark, of the Johns Hopkins School of

Hygiene and Public Health, has reported to the Society of Hygiene of the Johns Hopkins University and the American Physiological Society. How the cataracts of old people and of workers in certain industries develop may now be explained on the basis of Dr. Clark's research.

Cataract is an opacity of the eye lens or its capsule. Because one can not see through an opaque lens, blindness results. The protein of the eye lens and other protein solutions are denatured or changed by the action of ultra-violet light. When this light denatured lens protein is heated or if a small amount of calcium or lime salts is present, the protein coagulates and becomes opaque.

The initial process of light denaturation may occur in the lens protein without any visible opacity, because normally only potassium salts are present and calcium salts are not. Presumably, although Dr. Clark did not make the point, this is the reason why not every one develops cataract as a result of the every-day exposure of the eyes to some ultra-violet light from sunshine.

"There is probably always some denatured protein present in the lens as the result of exposure to sunlight, and the amount may increase with age owing to the lowered metabolism of the lens. This denatured protein does not precipitate in the presence of potassium, but a calcium concentration as low as five hundredths of one per cent. in the lens is sufficient to precipitate it at body temperature." An accumulation of denatured protein in the lens in old age combined with a higher amount of calcium in the blood may therefore be responsible for senile cataract.

The coagulation of light-denatured proteins is greatly hastened by heat. It is probable, therefore, that the larger number of cases of cataract in workers with molten glass and metals is due to an increased rate of precipitation of light-denatured protein when the lens is heated above body temperatures by exposure to large sources of heat such as these workers experience.

To prevent the denaturation of the lens, which seems to be the first step in cataract formation or production, Dr. Clark recommends that the eyes should be protected from radiation or light containing even moderate amounts of ultra-violet rays.

ITEMS

AN exceptionally large and brilliant meteor, so bright that it was clearly visible against the setting sun, was reported to Harvard Observatory by Professor William R. Ransom, of Tufts College. It was sighted on October 22 at 5:10 P. M. in practically broad daylight almost due west and traveling almost vertically. It appeared fairly high in the sky, traveled on a path about thirty degrees long, and disappeared about twenty degrees above the horizon. Its head was about half as wide as the full moon. It had a rather large tail and was brilliant bluish-white in color. Several other similar reports were made to the Harvard astronomers. The meteor was also seen from New York City.

FOREST fires, raging in the Los Angeles region and menacing elsewhere, might have been far worse this fall if the woods had not been full of C. C. C. workers. Latest figures available at the National Forest Service show that

forest fires this fall in national forests over the country as a whole, have numbered 9,512, as against a preceding five-year average of 7,601—an increase of about twelve per cent. But the total area burned this year has been only 192,040 acres, as against a five-year average of 417,603 acres—a decrease of well over half. Forest Service officials give full credit to the C. C. C. workers for this creditable showing in reduction of loss. In the first place, armies of fire-fighters stand "at the ready" all the time, so that counter-attack against the flames is much more prompt than it used to be. But more basic and permanent has been the work of the C. C. C. in building fire roads, clearing fire breaks, cleaning up accumulations of slash and snags.

RAINFALL for the coming winter season in the lowlands of southern California is expected to be about equal to the average for the seasons during the period 1916-1934. In the mountains the indications are for about five per cent. excess over this eighteen-year average. Statistical calculations based on surface temperatures of the ocean, by Professor George F. McEwen, of the Scripps Institution of Oceanography, have yielded these "indications"—for Professor McEwen prefers not to give them the more positive names of forecasts or prophecies. Similar calculations for air temperatures indicate that in San Diego it will be cooler than average this winter, while a little farther to the north, in Santa Ana and Riverside, it will be warmer than average.

NEW finds of the art of the Crô-Magnon cave men have been made in two caverns in the province of Guadalajara, Spain, by a father-and-daughter team of archeologists, Juan Cabré and Maria de la Encarnacion Cabré. The style of the drawings identifies them as belonging to the Aurignacian period of Old Stone Age culture; they include as subjects plants as well as animals, and men or at least man-like figures—for the human representations are far less realistic than those of animals. The man-like drawings are shown in both hunting and fishing scenes, and at least one of the figures is shown swimming. Many of the animals represented are extinct, or at least are no longer found wild in Europe. These include bison, aurochs, rhinoceros, wild horse and wolverine. Among animals still existing in the wild state are deer and goats, together with the representation of one bird.

A NEW chemical method of making crude rubber plastic, as a preliminary to the production of rubber products, is announced by E. I. du Pont de Nemours and Co. The older method of plasticizing crude rubber consisted of the power-consuming technique of grinding and mashing it. Ira Williams and C. C. Smith, of the du Pont research staff, have found that chemical treatment will turn the crude rubber into the desired plastic form. The discovery is considered to be the most important work since the development of the synthetic rubber—DuPrene. A large saving in power is possible by the new method and it is believed that the quality of the final rubber products—tires, etc.—will be slightly improved. Technical chemical details of the discovery have not yet been made available.



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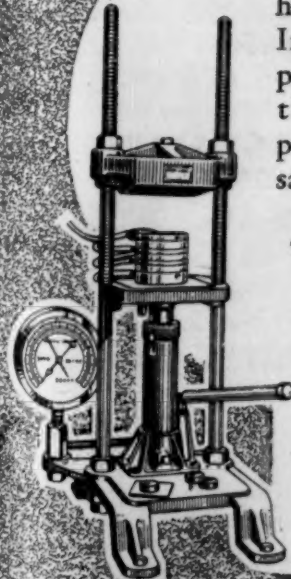
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SCIENCE NEWS

Science Service, Washington, D. C.

A MALE TUMOR HORMONE

EVIDENCE that male human beings, under certain conditions, will produce large amounts of a hormone identical with that occurring in the body fluids of women during pregnancy was presented at the recent meeting of the American College of Surgeons by Dr. Herbert M. Evans, professor of biology at the University of California.

Dr. Evans stated that with the collaboration of Dr. Miriam E. Simpson he had been able to demonstrate that when the male sex glands are invaded by tumor, a hormone is produced which reacts exactly the same on other animals as "prolan," the hormone produced in women during the development of the child embryo. In other words, the rapidly proliferating tumor cells lead to the same result as the proliferating cells of a foetus, although one occurs in the male and the other in the female.

This determination, it was pointed out, indicates the necessity for extreme care in measuring the strength of hormone dosage. When experiments on the hormone from males with tumor of the gonad were first started it was believed that this substance was far stronger in its effects than "prolan" from pregnant women. The conclusion was that it compared in strength of effect with the sex stimulating hormone from the anterior lobe of the pituitary gland or the hormone from pregnant mares.

However, suspicions were later aroused as to the accuracy of the unit measurements commonly used in hormone administration. Careful checks were made and these revealed that when care was taken to equate the unitage of "prolan" and the hormone from males with tumor of the gonad, the effects were identical. With the cooperation of Drs. Horlein, Schulemann and Laqueur, of the chemical laboratories of the Interessen Gemeinschaft at Elberfeld, Germany, it was shown that both hormones led to the same stimulation of the ovaries in immature rats. It was found that when immature female rats were given doses of either hormone in amounts between 5,000 and 20,000 units, ovaries of 200 or more milligrams in weight were produced.

A re-check of the comparative effects of the two hormones on pigeons indicated that in this case also the true unit value of "prolan" was determined it yielded the same gonad stimulation as the newly-obtained hormone from men suffering from the disease, teratoma testis. The effect of the two hormones is also the same when administered to rats lacking the pituitary gland, both male and female.

In conclusion, Dr. Evans said, "Ovarian weights will increase fairly rapidly following injections of the pregnancy hormone prolan in doses of 50 to 100 times the minimum rat unit. Very slight increases occur as the dose is increased up to 5,000 rat units. But when the dose is raised to 10,000 or 20,000 units, the ovaries increase to giant size, comparable to that achieved by administration of the male tumor hormone or ordinary doses of extracts from sheep pituitary glands. In every case the male tumor hormone shows its close relationship to the female pregnancy hormone prolan."

STRATOSPHERE AIR

TINY evacuated glass vials the size of medicine droppers are being used to trap samples of the air 13 miles in the stratosphere, according to the report of Professor F. A. Paneth and E. Gluckauf appearing in the current issue of *Nature*. The evacuated glass tubes are sent aloft from the upper air section of the Kew Observatory on small sounding balloons; broken at a predetermined height, they catch a sample of the atmosphere and then are sealed up again after fifteen seconds.

The object of the tests is to check the kind of gases which make up the stratosphere at heights where the compositions will be fairly stable and not disturbed by the winds creating turbulence at lower levels.

Extremely sensitive chemical analysis is used to measure the amount of helium gas present in the sample, for the sample contains only a few cubic centimeters altogether. An accuracy of one per cent. in a total volume of two cubic centimeters is attained. The first finding of the work disclosed that at a height of 13 miles the stratosphere air contains eight per cent. more helium than at the earth's surface.

Because of the fact that air is a mixture of gases the composition of the atmosphere at great heights should vary with the altitude. The best way of checking this fact, according to Professor Paneth and his colleague, would be to measure by chemical analysis the hydrogen content of the air in the stratosphere. The proportion of hydrogen is too low, however, to enable the use of any present methods. The next best indicator possible is the helium content.

To reach altitudes greater than twelve miles with the equipment, weight must be kept down, and as a result only small samples of the air can be taken. The sample apparatus is dropped to earth on a small parachute. It is found that up to heights of 11.18 miles (18 kilometers) the mixing of the gases has not yet given place to diffusion but at 13.05 miles (21 kilometers) eight per cent. more helium exists than is found at sea-level.

Much more research is needed on the problem and six cubic centimeter samples are requested from workers in better climates in other parts of the world.

GREAT AGGREGATIONS OF STARS EACH
LIKE OUR MILKY WAY

A DENSE cloud of island universes, each of them similar to our own Milky Way, but so far out in space that they can be seen only with the most powerful telescopes, has been located near the southern constellation Horologium by Dr. Harlow Shapley, director of the Harvard Observatory.

Evidence of their existence first appeared in the largest existing catalogue of external galaxies tabulated during the past five years by Mrs. E. M. Lindsay, of the Harvard astronomical staff. Almost all the 7,889 galaxies in the Horologium area contained in the catalogue were previously unknown, and quite understandably so, since nearly all of them are fainter than the fifteenth magnitude.

From a survey of the long-exposure photographs taken with the powerful Bruce telescope the observatory at Bloemfontein, South Africa, from which the catalogue was made, Dr. Shapley has estimated that the metagalactic cloud is populated about twice as densely as space in general. Several denser concentrations or clusters of galaxies within the cloud, he has estimated, are populated as much as three times as thickly as average space.

Just how thickly filled with galaxies this area is can be understood better from the fact that the 7,889 galaxies recorded in the catalogue are in an area covering less than one per cent. of the total sky. This entire area, according to Dr. Shapley, is "a congested region," one which, by his definition, contains one or more galaxies for every five thousand trillion cubic light years.

The catalogue is part of a general program for the surveying of external galaxies in progress at Harvard, two others having been published during the past five years for other regions of the sky. In all of them celestial bodies are classified according to position, brightness, diameter, form and structure.

Previous to this catalogue for the Horologium area, the largest ever made was the famous "New General Catalogue," published in Ireland fifty years ago, which contains tabulations for about 7,000 bodies. This earlier catalogue, however, contains almost exclusively objects brighter than the fifteenth magnitude and covers the entire sky, while the Harvard one is limited to a very small area and deals almost entirely with bodies fainter than this magnitude.

AN IMPROVED TELEPHONE TRANSMITTER

A NEW type of telephone transmitter for desk-type phones, which brings as much improvement in the art as all the previous developments in the last forty years, was announced at the Bell Telephone Laboratories, in New York, before the group of banking and business executives on the tour of leading industrial research laboratories of the National Research Council. Two thousand installations of the high quality, improved type phone are now being put into commercial operation for study in actual service, according to Harvey A. Frederick, engineer in charge of the development.

In a test demonstration the industrial and financial executives listened in on a phone conversation between two desk stand instruments. The average amount of line and room noise was then inserted in the circuit and the transmission gradually weakened until it was barely possible to hear what was being said. A further increase in the noise level was then made. With these unfavorable conditions, under which it was found impossible to understand the conversation, the new telephone set was switched in, and the listeners found they could again hear clearly.

Still using the new development set, normal noise conditions were reestablished and the listeners were shown what happens if the range of sound frequencies is varied. Lack of low-pitched sounds makes the talk seem thin and faint, while cutting out high-pitched sounds makes it difficult to understand.

In appearance the new set differs radically from pre-

vious types, for all parts of the telephone in a user's home are on the desk or table. The familiar black box mounted on the wall now serves as the base of the set and contains a more compact bell ringer, the induction coil and a quieter dialing device.

The transmitting unit is known as the capsule type. It is a simplified, compact adaptation of the costly radio microphone. No accessory amplifying equipment is needed, however. Its frequency range, Mr. Frederick explained, runs from the bass tones of the human voice, at about 150 cycles, into a treble pitch of about 5,000 cycles.

Over 300,000 installations of this new type of capsule transmitter have already been made in present hand-set type phones with the aid of an adapter. Less than one in a thousand of these have failed in service. So standardized is the transmission quality of the capsule type transmitter that the variation from one to another in energy characteristics is only one half a unit of sound energy—the decibel. The human speaking voice between different people, for comparison, may vary by 20 decibels, or a ratio one hundred times as great.

A BIRD-LIKE DINOSAUR

BONES of a "late-model" dinosaur, that lived some 120 million years ago, have been brought to the U. S. National Museum by Charles W. Gilmore, curator of vertebrate paleontology. Although its live weight was probably about three quarters of a ton, it was built very much along the lines of a running bird, and had bird-like feet with three toes each.

This modeling for speed and relatively light weight, Mr. Gilmore explains, may have been due to the need for greater speed in the later days of dinosaurian domination, when competition had become severe and race-survival was to the swift. The loss of two toes out of the standard set of five possessed by earlier dinosaurs was one important item in this evolution toward greater speed in running. The same thing has happened among running mammals, reaching an extreme in the horse, which has only one working toe on each foot.

Mr. Gilmore's find is important, for these bird-like dinosaurs were apparently never abundant. It is not yet known how complete the skeleton is; but it seems to be a much more nearly complete specimen than those now in museums, which are usually assembled from fragments of several different skeletons.

With the fossils of the bird-like dinosaur Mr. Gilmore found the remains of duckbill dinosaurs, horned dinosaurs, armored dinosaurs and extinct genera of turtles and crocodiles.

ITEMS

DISCOVERY of a large oval "bowl" where prehistoric America's exciting games were played 800 years ago has been announced by Dr. Harold S. Colton, of the Museum of Northern Arizona. The discovery was made in northern Arizona near Flagstaff, by a joint expedition of the museum and the Arizona State Teachers College, of Flagstaff, led by J. C. McGregor. The find surprises archeologists, because never before has it been realized that ball games—national sport of Mayas, Aztecs and

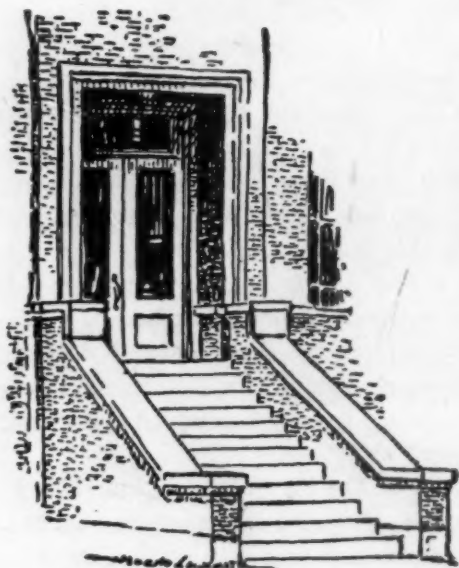
other Indians of Mexico—were popular over so wide an area of ancient America. The game court now excavated is an oval bowl about 100 feet long and 45 feet wide, with slightly pointed ends. The sloping sides, Dr. Colton said, must have been seven or eight feet high, and the floor was level. Entrances were in the north and south walls, and a goal made of four rocks in the floor was at the south end. The plan somewhat resembles ball courts used in prehistoric Mexico.

FLATHEAD chiefs in colorful regalia of feathers and buckskin have watched the Secretary of Interior, Harold Ickes, sign an important document. While news cameras flashed and clicked, the Government of the United States presented to the Flathead Tribe of Montana the first tribe constitution approved under the Indians' new deal. The document, prepared mainly by the tribe itself and accepted by popular vote five to one, gives the Flathead Indians the legal machinery for organizing their own group and taking over a large measure of power over their own affairs. All Indian tribes who accept the provisions of the Indian Reorganization Act, passed by the last Congress, may work out their own constitutions, and a number of tribes have been actively engaged in this task.

ANOTHER sinus, besides the ones already so well-known for the suffering they cause, can contribute its share of ails and pains, Dr. Chester H. Bowers, of Los Angeles, reminded members of the American College of Surgeons. This sinus is known as the sphenoid. It is located far back of the nose, approximately in the center of the skull,

lying close to the brain and perhaps in intimate relationship with half of the cranial nerves and important blood vessels. It is usually not involved in disease, but it may be the hidden cause of many disagreeable symptoms. Headache, reflex pain over a canine tooth, pain or continuous burning in the throat, pain in the back of the head or even in the ear are among the symptoms which may be traced to trouble with the sphenoid sinus. Involvement of this sinus may also interfere with vision because the optic nerve is separated from the sphenoid sinus or cavity by a very thin wall.

EROSION-CHECKING grasses and other plants that can fight the droughts, winds and occasional floods of the Great Plains area have been sought in Asia by three expeditions of the U. S. Department of Agriculture. Now the explorers' work finished, the seeds and cuttings are being tested under field conditions at four stations in the West by agronomists. The expeditions were in Asia at various times during the past two years. One, under H. G. MacMillan and J. C. Stephens, collected in Manchuria. A second, under the direction of H. L. Westover and C. R. Enlow, traversed Russian Turkestan. The third, under Professor Nicholas Roerich, worked in northern China. The scientific spoils thus far checked number well over 2,000 lots of seed and planting stock, with some shipments yet to be accounted for. Among them are 798 grasses, 555 legumes and 889 miscellaneous items. By far the greatest number of packages received were in the Westover-Enlow collections.



Entrance to the Mead Johnson Research Laboratory, Evansville, Ind. The building is designed to provide for present undertakings and allow for change and expansion required by new projects. Equipment is the best obtainable, modern and adequate. Resources are ample for initiating and conducting investigations of worth.

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The Science Press Printing Company was established to print *SCIENCE* and the other publications of The Science Press, including *The Scientific Monthly*, *The American Naturalist*, *School and Society*, and the Biographical Directories of "American Men of Science" and "Leaders in Education." The composition and press work of these publications show the high standards that are maintained. In order to bring them out efficiently and promptly—for example, the entire contents of an issue of *SCIENCE* can be put in type in one day and each week during 1934 about 13,000 copies of *SCIENCE* were printed, bound and mailed in a little more than one day—it has been necessary to have a shop of considerable capacity and to take in other work. The press now prints some thirty scientific and educational journals and series, and has printed many books and monographs.

It is an advantage for scientific men to have relations with a company that maintains the same rates for the same kind of work under the same conditions. High pressure selling and competitive bidding—among the causes of the present economic depression which the codes promoted by President Roosevelt are intended to abolish—are thus unnecessary. A scientific man may assume that work entrusted to the press will be done at a cost as low as is consistent with high standards of work and the best conditions of employment for the workers. This is less than the cost of equally good work in large cities where wages and rents are much higher, but it is not so low as for inferior printing or where the welfare of workers is disregarded.

Adequate facilities for the publication and printing of research work are essential for the advancement of science. The cost of conducting a piece of research that deserves publication, counting the time of the scientific workers and all overhead, may on the average be \$2,000. The charge for printing by The Science Press Printing Company of a 32 page article or monograph in an edition of 1,000 copies is about \$80, say 4 per cent. of the cost of the research. This is less than the interest on the investment, if there is a delay of a year in publication. Ordinary depreciation on machinery is charged at 10 per cent. a year, but it is much larger in the case of scientific research where delay seriously lessens the usefulness of the work and prevents the early recognition of its value. It is most important for science and for scientific men that there shall be prompt and efficient printing and publication of research.

The Science Press Printing Company now wants one or two scientific journals or several books and monographs in order that the full capacity of the shop may be used and all employees be given steady work. This is not only a need of the press but also an opportunity for those who take advantage of it. It is further reasonable to assume that The Science Press Printing Company deserves the support and cooperation of scientific men to the same degree as an institution, a society or a journal that contributes to their welfare and to the advancement of science.

Dr. J. McKeen Cattell was responsible for the organization of The Science Press Printing Company eleven years ago and has been president of the corporation. Since the untimely death in 1927 of A. E. Urban, the first secretary and manager, Jaques Cattell, one of the editors of the last two editions of "American Men of Science," has been secretary and later also vice-president; George M. Houck has been associate manager in charge of the composing room and later manager; Miles W. Eckman has been associate manager in charge of the press room. Inquiries concerning printing should be addressed to the secretary at Lancaster, Pennsylvania.

THE SCIENCE PRESS PRINTING COMPANY
LANCASTER, PENNSYLVANIA

New York Office
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SCIENCE NEWS

Science Service, Washington, D. C.

RADIO RECEPTION WITHOUT STATIC

VISIONS of the day when a severe electric thunderstorm will no longer bring crashing static in home radio receivers became a virtual reality when Major Edwin H. Armstrong, professor of electrical engineering at Columbia University, showed his colleagues his static-free, non-fading system of radio transmission. From a small experimental radio station at the top of the lofty Empire State Building Major Armstrong has been testing the system for over a year with receivers scattered about the metropolitan area.

Signals from the little 2,000-watt station were recorded 85 miles away on a phonograph record while a bad lightning storm was in progress. Uninterrupted reception and no static was the result. For comparison WEA's big 50,000-watt station, recorded at the same time, gave signals full of crashing jars and often unintelligible.

Major Armstrong also sent a radio facsimile copy of the front page of a newspaper through electric storms. Clear readable copy was received. The absence of blurriness denoted the freedom from static. At the same time a musical program was simultaneously transmitted. This is the first time in his experiments, Major Armstrong said, that music and the printed word have been sent and received together.

The fundamental point about the new static-free system, Major Armstrong explained before the Institute of Radio Engineers, is the introduction into the transmitted waves of a characteristic which does not exist in radio waves that nature created in causing static. The receiving set is so constructed that it picks up those radio waves having the special "man-marked" characteristics and discards the natural ones of static. "The theory on which the problems were solved flies directly in the face of all previous mathematical deductions. The old theory of the way to shut out static assumed that the best that could be done was to narrow the band of the selective systems at the receiver as much as possible without shutting off the signal. By narrowing the band down to a width just sufficient to admit the signal it was believed that the ratio of signal to static strength would be best. Where the signals and disturbances are of the same order of magnitude, I find the exact opposite to be true. With proper methods of transmission and reception, the wider the band, the better will be the signal to noise ratio."

The Armstrong experiments have been carried out on a wave-length of two and a half meters and have applications, it is indicated, in television broadcasting. The range of the extra-short waves is only over visible distances. The waves will not bend around the curvature of the earth. It was because of this that a sky-scraper was used for the transmitting station.

RADIOACTIVE PHOSPHORUS IN THE BODY

THAT bone formation is an ever-changing process in the body and not a happening occurring only during youth is suggested by experiments reported in *Nature* by two Danish scientists.

Using phosphorus made artificially radioactive so that its atoms could be "traced," Professor Georg Von Hevesy, of the Institute of Theoretical Physics, and Dr. O. Chiewitz, of the Finsen Hospital, Copenhagen, have studied the absorption of phosphorus atoms in bone formation.

Using experimental rats, it was found that the phosphorus atoms fed in the food take about two months before they come out of the body. They report: "The experiments suggest strongly that the formation of bones is a dynamic process continually taking up phosphorus atoms which wholly or partly replace others."

It was found that 30 per cent. of the phosphorus atoms deposited in the skeleton of an adult rat were removed in the course of twenty days, and that the front teeth absorbed ten times as much phosphorus as the average for the whole skeleton. The molar teeth, by contrast, absorbed less than the average.

The technique employed in the experiments was to add radioactive phosphorus to one milligram of ordinary inactive phosphorus to such an extent that the Geiger counter, used in detecting the radioactive element, registered 1,000 clicks a minute. Thus if any product obtained later by subsequent biological or chemical reactions gave only one click a minute, only one thousandth of a milligram of the inactive phosphorus was present. The ability of radioactive phosphorus atoms to act as tracers through the animal body is comparable with research on heavy water whose "heavy" isotopic atoms can similarly be used for tracing biological happenings.

Last January Professor Hevesy reported that if a person drinks a glass of water nearly half of it is still in the body after nine days. He used the heavy hydrogen atoms in heavy water to detect the process of elimination. His present report on phosphorus absorption is similar research with a different chemical element.

TUNGSTEN ALLOY AND THE TREATMENT OF CANCER BY RADIUM RAYS

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A NEW tungsten alloy which effectively takes the place of more bulky lead as a "screen" when massive doses of radium rays are being administered has been developed for use at the Westminster Hospital in London.

The bomb-shaped containers in which large packs of radium are shielded in hospitals can be made much smaller with the new alloy and yet have the same screening effect. A volume reduction to nearly half the former size is attained. More compactness means the patient can be placed closer to the source of the radium rays, if need be, and receive more intense radiation.

The new tungsten alloy resulted from the researches of Sir John McLennan while he was scientific adviser of the Radium Beam Therapy Research Company, and Dr. C. J. Smithells, of the (British) General Electric Company. Sir John recently died while on vacation on the Continent.

When massive doses of gamma rays from radium are administered to cancer patients a large amount of radium

is necessary. Many authorities believe not less than four grams of radium, valued at close to \$200,000, is the minimum. This potent radium pack is shielded so that its piercing gamma rays do not strike doctors and nurses or any parts of the patient's body except the afflicted area. The complete equipment, radium and its shield, is known as a radium bomb.

Although lead is easily shaped and machined and is relatively cheap, it takes a somewhat unwieldy size of lead bomb to provide adequate screening for four or more grams of radium. The screening effect of lead is due to its high density (11.35), the degree of absorption of gamma rays by metals being nearly proportional to the density of the metal. Plainly a smaller quantity of a denser metal than lead would have an equivalent screening effect, but the only suitable metals in this category are gold, platinum and tungsten. Of these the first two are prohibitively expensive.

There remained tungsten, best known in the form of electric lamp filaments. Its high theoretical density (19.3) is only found when the metal has been treated by expensive metallurgical processes.

The difficulty of cost was overcome by the tungsten alloy. By adding from 5 to 10 per cent. of either copper or nickel an alloy of a density in the neighborhood of 17 could be successfully evolved on the desired scale, and for about \$5.00 per pound. The tungsten alloy radium bomb is only 64 per cent. as large as the lead bombs previously used. The size is in the ratio of the densities of the two materials, 11 to 17.

The alloy has been adopted for use by the Westminster Hospital for its 4-gram radium bomb now being constructed under the direction of Dr. H. T. Flint and C. W. Wilson. It is also to be used for the radium bomb at Birmingham, England.

EXCESS VITAMIN D REPORTED HARMLESS

TAKING large amounts of rickets-preventing vitamin D into the body causes no harm whatever, it is indicated in recent research by Dr. Harry Steenbock, of the University of Wisconsin, whose research has led to irradiation of food products to increase their vitamin D content.

With irradiation of food products becoming increasingly popular, there is a possibility that many persons consume vitamin D in excess of their needs. Since this vitamin increases the power of the body to fix calcium, it has been a matter of considerable speculation whether this element may be fixed in injurious amounts, or whether the vitamin D may have other undesirable effects.

Dr. Steenbock conducted feeding trials with experimental animals over a ten-month period, allowing them to consume vitamin D in far greater amounts than human beings are ever likely to do. While commercial irradiated milk usually contains about 50 Steenbock units of the vitamin per quart, he used milks varying in potency from this figure up to 5,000 units per quart. All the common methods of fortifying milk with additional vitamin D were employed. Some of the milks were laboratory irradiated, others were produced by cows fed irradiated yeast, and still others were supplemented with irradiated ergosterol and cod-liver oil concentrate.

The experimental animals were given no other food than vitamin D milk to which small amounts of iron, copper and manganese were added. They were given all they could drink during the ten-month period. All the animals grew well, were uniform in appearance and showed no evidence of abnormality whatever.

RACIAL SUPERIORITY AND STERILIZATION

Two widely held biological opinions which are claimed to be the basis of the present policy of one European nation are attacked by Professor J. B. S. Haldane, of the University of London. Sterilization of the unfit is not necessary for national hygiene, and the evidence that some races are superior to others is rather weak, Professor Haldane points out in his Halley Stewart lecture.

As far as improving national hygiene by decreasing the number of the unfit, other measures than sterilization are available in all cases, Professor Haldane observed, mentioning as alternatives chastity or birth control for mentally normal persons and segregation for defectives. "It is doubtful whether sterilization of all mental defectives would reduce the number in the next generation by 15 per cent.," Dr. Haldane said, referring to one of the arguments of those who favor sterilization of the unfit.

Professor Haldane has analyzed five classes of human abnormalities that are determined genetically, or in the popular phrase, are inherited. His analysis shows that sterilization would be very effective in the case of such abnormalities as lobster claw, Huntington's chorea and similar conditions which may all be determined by dominant genes. Sterilization would be moderately or slightly effective in other conditions associated with dominant or sex-linked genes or the cooperation of several genes. It would, however, be totally ineffective in conditions associated with inbreeding, as in the marriage of cousins.

Discussing the theory of racial superiority, he called attention to the fact that innate psychological characteristics of races overlap. Among the so-called races of Europe outside the Arctic there is also overlapping of physical characteristics. Some facts, he said, support the theory that racial crossings for humans as well as other animals are advantageous in the first generation but harmful in later ones.

SELF-PORTRAITS OF WOLVES

BLACK wolves take their own photographs at midnight, in the dark of the moon, in thick woods in the South. They live in the Singer Wildlife Refuge, on the banks of the Mississippi in northern Louisiana. Their photographs were taken by flashlight, with cameras set off by cleverly concealed electrical apparatus. The photographs, published in a new bulletin of the Chicago Academy of Sciences, constitute the first known self-portraits of timber wolves made in their natural habitat.

The pictures were secured by Tappan Gregory, of Chicago, with the collaboration of Robert S. Sturgis, of Chicago, Stanley Young, of the U. S. Biological Survey, and the assistance of a number of other Biological Survey workers.

To obtain an animal self-photograph, a charge of flashlight powder, with an electric fuse to fire it, is set

on a post in a paraffined cardboard box. The wires from the fuse run to a device that closes the circuit when the animal brushes against an invisibly fine wire or steps on a buried tread. So well concealed are these mechanisms that they do not show in the resulting photographs, and the animal might easily be a thousand miles from the nearest works of man, so far as visible evidence goes. The air-concussion from the explosion of the flashlight powder is used in another mechanism to snap the shutter of the camera, making the whole process automatic.

Making wolves and other beasts of the forest take their own pictures at night is not as simple as it sounds, however. Mr. Gregory tells of a score of vexations that beset the man who hunts wolves with a camera. Other animals, from wandering pigs to over-inquisitive raccoons and bait-stealing skunks, often fire the flash, wasting all the work of a night's set-up. The apparatus itself may "go hay-wire" due to moisture, corrosion or mechanical accidents.

But patience, and everlasting willingness to try it again every time something goes wrong, in the end bring their reward, in the shape of first-class pictures of the "Big Bad Wolf."

ITEMS

A SMALL pilot balloon bearing automatic recording instruments has ascended to a height of 18.3 miles—a new record for Russian work in this field—at the Institute of Aerology in Slutsk. At an altitude of eight miles the temperature registered by the device was seventy degrees below zero Fahrenheit. At 11.8 miles the temperature rose to minus 58 degrees Fahrenheit; at 16.7 miles it was minus 52. From this last point to the maximum at 18.3 the temperature stayed constant.

THANKS to rigid game laws, Sweden now has the largest stock of wild moose in Europe, according to Wilhelm Kugelberg, a game preserve official. One hundred years ago the animal was found only in certain parts of the central provinces, Vermland and Dalecarlia, whereas today there are large herds of moose in practically every part of the country. There is very little poaching, for the people as a whole take great interest and pride in the preservation of the animals. During the annual open season, which lasts only a few days, more than 6,000 animals are killed; but the game laws and the virtual absence of illegal shooting has helped to increase the stock enormously.

WILD wheat, in many distinct varieties, has been found growing on the foothills of the Ararat region in Armenia. The authorities of the Armenian Autonomous Soviet Socialist Republic have set aside the area as a scientific reserve, not to be cultivated or grazed, because of the value of such wild wheat varieties in the study of the origin of cultivated wheats, and also in genetic experiments looking to the improvement of the cultivated varieties in resistance to frost and drought.

It was a lighted sea worm, not a flickering torch in the hand of a native, that Columbus saw from his flagship the anxious night before he discovered America. With this biological explanation, one of the mysterious fea-

tures of the discovery voyage is believed cleared up at last. The light, which Columbus described as "like a small wax candle which rose and fell," was probably the luminous display of sea worms known as syllids, according to a report in *Nature* by L. R. Crawshaw, of the Marine Biological Association Laboratory at Plymouth. October is one of the months in which the illumination has been noted and it occurs usually around the last quarter of the moon, both points fitting America's discovery date.

AFTER the first of January, all applicants for a marriage license in the State of Connecticut must pass a Wassermann or Kahn test before a license will be granted. The certificate must be based on a blood examination by an approved laboratory. The blood examination will exclude the possibility of syphilis. Other states requiring medical examination upon the issuance of a marriage license are Wisconsin, Oregon, North Dakota, Alabama, Wyoming and Louisiana. The State of North Carolina repealed its law this year.

THE latest device to attract customers at fairs is an apparatus for measuring blood pressure. For a dime the customer learns what his blood pressure reading is. If he is of the nervous type, he begins to worry. The great danger to the public is in the use of such apparatus without the necessary medical background for interpreting the results, according to an editorial in *The Journal of the American Medical Association*. "Any single reading of blood pressure, pulse rate or even temperature, without relationship to the general physical and mental condition of the person concerned, is bound to lead to false interpretations and the associated hypochondria," the editor states. When approached by physicians, the manufacturers of such apparatus "protest earnestly and long that they are doing their utmost to stop the sale of such devices to persons outside the medical profession."

WITH light reflected from the top of a tower forty feet high, astronomers at the McMath-Hulbert Observatory of the University of Michigan at Lake Angelus will soon be able to make movies of the sun in the light of a single glowing element in its atmosphere. In this way they will record the solar prominences, great flame-like masses of hydrogen that often shoot out from the sun's surface to heights of hundreds of thousands of miles, and solar "bombs" that are occasionally projected high above its surface and then explode. The tower telescope, now being constructed under the supervision of Robert R. McMath, one of the founders of the observatory, will have two flat mirrors at the top to pick up the sun's light. One will turn with the earth, so as to follow the sun across the sky. The other will reflect the light into a lens immediately below, and this in turn will form a four-inch image of the sun in a building on the ground. Underneath, a pit thirty feet deep will hold the spectroscopic through which the sun's light can be analyzed. Similar telescopes have been built at the Mount Wilson Observatory in California, and in Potsdam, Germany; Arcetri, Italy, and Kyoto, Japan.

The Journal of General Physiology

EDITED BY

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SCIENCE NEWS

Science Service, Washington, D. C.

NOBEL PRIZE AWARDS

BY WATSON DAVIS
Director, Science Service

THE Nobel prize awards to Professor F. Joliot and Mme. Irene Curie-Joliot, in chemistry, and to James Chadwick, in physics, recognize two of the most important achievements in physical science in recent years: Discovery of the neutron, now considered one of the three ultimate particles of all matter in the universe—the achievement of James Chadwick, of the University of Liverpool, and at the time of his discovery in 1932 at Cavendish Laboratory in Cambridge, England. Discovery of artificial radioactivity and manufacture of new radioactive elements—the achievement of the Joliotis early in 1934.

The award to Irene Curie, as she signs her research papers, marked the first case of child of a Nobel prize winner receiving the Nobel prize. For Mme. Joliot is the daughter of the late Pierre and Marie Curie, Nobel laureates jointly with Henri Becquerel in 1903 for their work on radioactivity. The mother of Irene Curie also received the Nobel prize in chemistry in 1911.

The discovery of the neutron by Mr. Chadwick grew out of the modern alchemy of physics whereby transmutation is accomplished—not the turning of lead into gold desired by the ancients, but more important to science, the turning of many light atoms into other elements in small but significant amounts. Lord Rutherford, head of Cavendish Laboratory, knocked “H” (chemical symbol for hydrogen) out of nitrogen in 1919. There was one light-weight element, beryllium, that resisted similar transmutation, and it was an attack on this metal that produced neutrons.

When bombarded with a stream of helium atomic hearts let loose by that radioactive cousin of radium called polonium, there was produced from beryllium a stream of powerful radiation. The Joliotis in Paris and two Germans, Bothe and Becker, thought that it was the well-known gamma radiation so useful in cancer treatment, but Mr. Chadwick recognized it as a stream of electrically neutral particles which had been suspected from theory and had even been named “neutrons” before discovery. Because of its electrical neutrality, the neutron has the ability to plunge itself into places that can not be reached by other atomic particles. It was immediately seized upon as a very welcome tool for prying open the atom.

Two years later the achievement of artificial radioactivity by the Joliotis was world-acclaimed. The persistence and unchanging nature of natural radioactivity has perplexed scientists. Try as they will, they can not speed, slow or otherwise change an iota the constant natural disintegration of radium or any other radioactive substance.

Man-caused radioactivity was first produced in aluminum. A stream of helium atom hearts was flung at a thin foil of this metal. Out came first neutrons and then

a stream of positrons, another atomic particle discovered in 1932 by Dr. Carl D. Anderson, of the California Institute of Technology. What was unusual and important is that the positrons were flung off for many minutes after the bombardment stopped. The atom was disintegrated not like an explosive shell but like an incendiary bomb. Here was radioactivity made to order. There was great activity in laboratories as atomic particles of various kinds were flung by high voltage current at various substances. A large number of substances were transmitted into new radio-elements that lived for minutes, hours or a few days, and then blew themselves up with release of powerful radiations. There was hope aroused that these new radio-elements would be of medical and industrial importance. To-day it is known that plans are under way in one laboratory at the University of California to produce radiosodium in quantity in the hope that eventually it can be used in the treatment of disease through its injection into the blood-streams of the patients.

The two American centers of research where the researches of Mr. Chadwick and the Joliotis have been supplemented most intensively are at the University of California, under Professor E. O. Lawrence, and at the California Institute of Technology, under Dr. C. C. Lauritsen. Both institutions have apparatus for producing the high voltage current necessary for flinging various atomic particles at different sorts of matter. Another atomic particle, the positron or positive electron, was discovered by Dr. Carl D. Anderson at the California Institute of Technology in 1932 shortly after Mr. Chadwick's discovery of the neutron.

THE STRATOSPHERE ASCENT

THE success of the Armistice Day stratosphere flight of the balloon *Explorer II*, bearing Captain Albert Stevens and Captain Orville Anderson to new altitude records, hung in the balance for an hour and a half during preparations for the take-off. Press reports merely said, “A rip in the balloon fabric was discovered during the inflation and repaired.”

But both the men in the balloon and members of the advisory committee on the ground held their breath every instant the balloon was aloft hoping the great 20-foot-long patch would hold. It did, and the Army's non-commissioned balloon officers from Scott Field have won thanks which in war time would merit military citation. Their names are Master Sergeant J. H. Bishop and Staff Sergeant Olaf Jensen. Working with them were J. F. Cooper and J. R. Kelly, of the Goodyear Company, which constructed the balloon bag.

When the two stratosphere balloonists reached their highest altitude, they looked down upon what is normally considered the sky. So much of the air and dust particles of the atmosphere lay beneath them that the white or hazy sky, made that color by the scattering of light, was down and not up. The sky above and outward toward the horizon was deep violet, which indicated that the red

and green or longer wave-lengths of light had been captured and dissipated by the lower atmosphere. If Captains Stevens and Anderson had had ultra-violet eyes the sky above them would have been brighter with light shorter in wave-length or, what is the same thing, higher in frequency of vibration. They were to an extent like men on the moon or on Mars in that they could look upon the earth from outside it. What they saw was very much like what could be seen from the earth's satellite or nearby planets, except they had a magnified view.

The human eyes of the two balloonists could not see through the mistiness of the atmosphere below them as well as the mechanical eyes that their gondola carried in the form of cameras with red and deep red filters. These infra-red photographs when developed will have detail that a mere human eye could not see.

A number of scientific men gathered at the headquarters of the National Geographic Society during the ascent of the balloon, which rose to a new record height of over 74,000 feet. By radio they not only heard what was going on in the balloon, but were able to act as "cerebral screw-drivers or pliers" as one of them put it. Dr. W. F. G. Swann, member of the scientific advisory committee of the flight and with valuable cosmic ray apparatus automatically working aboard the balloon, was in New York city and Captain Stevens was twelve miles up in the stratosphere over the now barren winter-touched Nebraska countryside.

Nothing went wrong with the cosmic ray equipment but by radio Dr. Swann would have been able to offer emergency advice if it had. In Washington, Dr. Lyman T. Briggs, chairman of the advisory committee and director of the National Bureau of Standards, talked with Captain Stevens about the progress of the experiment on measuring the electrical conductivity of the stratosphere.

To Dr. Briggs and Dr. L. B. Tuckerman, also a member of the committee, Captain Stevens told of opening the apparatus for catching spores just after the balloon reached its peak altitude and began the descent. At each whirl of the automatic camera-exposing mechanism they relaxed, for they knew the multi-cameras were taking pictures of the ground below and making permanent records of the invaluable data being registered on the dials. What those dials read during the flight will tell many things. How does the temperature vary high in the stratosphere is only one, for example. Of keen interest also are Captain Stevens' observations on the color of the sky at the maximum altitude. Was it black as previously reported, or a normal blue? The answer seemed to be a very dark blue-black, almost a deep violet.

RICKETS AND VITAMIN D MILK

DISCOVERY in recent years of methods of adding the sunshine vitamin D to milk and other foods seems to justify the hope that the public health problem of preventing rickets can be solved, according to Dr. Fred O. Tonne, of the Chicago Board of Health, who spoke at a conference on irradiation held in New York City by the Wisconsin Alumni Research Foundation, which holds patent rights to one method of adding vitamin D to foods and medicines.

The individual child may be safeguarded from rickets by the guidance of his own doctor, but for the great mass of children in the country, many of whom do not obtain medical care unless seriously ill, preventing rickets seems to be the problem and responsibility of the health officer.

One measure of protecting large numbers of children against rickets may be the addition of vitamin D to milk. Dr. Tonne pointed out that the value of vitamin D milk from the public health standpoint can not be estimated definitely, yet because of the short time since its introduction and the small amount consumed. However, in Chicago during the past year, the consumption of fluid and evaporated vitamin D milk has amounted to 16 per cent. of the total milk sales. During the same time severe rickets has disappeared and milder forms have declined noticeably in a group of pre-school children examined regularly every year at child welfare stations. It is, therefore, believed that vitamin D milk should be given a more general trial as a rickets-preventing agent.

The parentage of vitamin D presents a knotty problem. Some of the latest angles uncovered in the search for the original substance that produces vitamin D under the action of ultra-violet light were described by Dr. James Waddell, director of the biological laboratory of the E. I. du Pont de Nemours and Company, at the American Institute meeting on ultra-violet light in relation to human health.

From the comparatively simple discovery that vitamin D is produced from ergosterol when irradiated with ultra-violet light, investigators have found that vitamin D is produced by the action of ultra-violet light on a great number of substances, including cholesterol, and that there is marked difference in the effectiveness of the vitamin produced from the different sources.

PURCHASE BY THE U. S. S. R. OF LOW TEMPERATURE APPARATUS AT CAMBRIDGE

SOVIET RUSSIA is to buy from Cambridge University the low temperature apparatus, including one of the world's most powerful electromagnets, which Professor Peter Kapitza has used in his experiments in atomic physics near absolute zero.

Professor Kapitza is the brilliant investigator who for some years did his research at the University of Cambridge in the Cavendish Laboratory of Lord Rutherford. Last spring he went home for a visit to Russia and was "detained" permanently because Soviet authorities decided his work was so valuable it might well be done in the U. S. S. R.

In an interview Lord Rutherford announced that a decision to accept the Soviet offer to purchase Professor Kapitza's apparatus had been reached by a joint committee of the University of Cambridge and the department of scientific research of the Royal Society. Lord Rutherford said: "I am thoroughly in favor of the scheme as adopted. I think, on the whole, it is the happiest solution which could have been found for this difficult problem. The amount of payment, you will understand, must be treated as private. A new large electromagnet will be installed at the Mond Laboratory

at Cambridge which will produce temperatures within a few thousandths of a degree of absolute zero."

Lord Rutherford and Professor J. D. Cockcroft, assistant director of the Cavendish Laboratory, were reluctant at first, it was disclosed, to continue researches on the problems of Professor Kapitza unless the latter, as a pioneer in the field, so desired.

The payment from U. S. S. R. will be amply sufficient to pay for the cost of building a new and more powerful electromagnet in England. Opinion regarding the purchase is that science will be aided in the end, for while a slight delay will occur in the low-temperature atomic research, eventually there will be two sets of equipment for the problem where there was but one before.

One line of research which will also be undertaken with the new Cavendish magnet will be atomic bombardment with apparatus of the cyclotron type such as used by Professor E. O. Lawrence at the University of California.

ITEMS

THE possibility of an influenza epidemic in the United States this winter appears in a radio report from Hawaii just received at the U. S. Public Health Service at Washington. In Honolulu there are approximately five thousand cases of influenza, three thousand of them among school children, Dr. L. D. Fricks, chief quarantine officer for the U. S. Public Health Service in Hawaii, reported. The influenza outbreak there started two weeks ago. The last big epidemic of influenza in the United States started in Hawaii, health authorities in Washington pointed out. That was in 1932. Starting with about ten thousand cases a week in Hawaii in June, the disease crossed the ocean and spread across the United States, reaching a peak of 90,000 cases which were reported the last week of December. At present, there is no appreciable increase in reports of influenza cases in the United States, but health authorities are watching the Hawaiian situation with considerable interest.

DEATHS from malaria are increasing to an alarming extent in the United States. The seriousness of the situation is pointed out by officers of the Metropolitan Life Insurance Company, who refer to "the rising menace of malaria" in their current *Statistical Bulletin*. According to their estimates, at least 900,000 persons are suffering from this preventable disease at the present time. This estimate is far too low, in the opinion of Dr. L. L. Williams, of the U. S. Public Health Service, who is in charge of malaria investigations. Dr. Williams estimates that there were two million cases of malaria in 16 southern states during 1934. He thinks the number of cases has dropped off a little since the 1934 peak, but the 1935 figures will not be available until the end of the year. The number of cases is not known exactly, but is calculated from the deaths reported. Some authorities estimate 200 cases for every death, but Dr. Williams believes 500 to 1,000 cases for each death is more nearly accurate. Malaria accounted for 4,520 deaths in the United States during 1934, the latest year for which figures are available.

POULTRYMEN are now being told how to color the egg inside the shell, making the yolk pale yellow or deep orange, to suit the egg-buying customers. Deep-colored egg yolks are liked for cake making, to give the cake a golden color. They are also in demand for some ice creams. Poultrymen can get hens to lay pale or deep yolks by the simple device of feeding them accordingly. Small amounts of pimento or Chili pepper in regular rations will give the yolks a deep orange-red color. Feeding white corn, instead of yellow, and limiting the green feed will make the yolks pale. But, hens on this latter ration will need cod-liver oil to supply the vitamin A they miss from not getting yellow corn. Richer shades of yellow may be obtained by increasing yellow corn and green feed in the ration, but too much green feed will give the yolks a brown or green off-tint.

THE process of making gasoline out of natural gas and waste refinery gas, known chemically as polymerization, has increased the nation's potential sources of motor fuel by 25 per cent. Speakers at the recent meeting of the American Petroleum Institute declared that with efficiencies now obtainable approximately 110 million barrels of polymer gasoline could be produced each year if necessary. Polymerization is the chemical process whereby waste refinery gases are made to combine in such a way that two or more molecules join and form a larger molecule, known as a "polymer." Not only can gasoline be secured in this fashion but also benzol, toluol and xylol, all important solvents.

DISCOVERY of the complete skull of a primitive carnivore, a flesh-eating mammal about the size of a cat, which lived in the lower Paleocene Epoch about ninety million years ago, has been announced by Dr. Glenn L. Jepsen, of the department of geology of Princeton University. The skull was found by the 1934 Scott Fund Expedition, of which Dr. Jepsen was the field director, in the Big Horn Basin of Wyoming about 25 miles northeast of Cody. With the exception of specimens uncovered by the 1935 expedition, which have not as yet been studied, it is believed that this is the only complete skull of this type which has ever been found. Among the finds of this summer's expedition, which are to be studied this winter, is part of a skull of the earliest known primate, the order to which monkeys, apes and man belong. Jaws of this species had been found by previous Scott Fund Expeditions, and it was tentatively given the name *Plesiolestes problematicus*, but it is probable that it will be reclassified in view of the more complete information made available this year.

SURFACING roads through vineyard regions, by the hot tar process, brings about bad flavor in the wine, is the claim advanced by German vintners. The tar vapors, that fill the air while the road work is going on, condense on the grapes, and tar particles settle on them out of the dust later on. Surfacing of roads with a cold asphalt emulsion is recommended as a way out of the difficulty.

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Participants in the approaching exhibition are listed above. The preview to appear in SCIENCE on December 13 will give a brief description of each exhibit.

There is still a small amount of space vacant, applications for which should be made to Dr. F. C. Brown, Director of Exhibits, American Association for the Advancement of Science, Smithsonian Institution Building, Washington, D. C.

SCIENCE NEWS

Science Service, Washington, D. C.

EXPERIMENTS ON HIGH PRESSURES AT HARVARD

EXPERIMENTS with staggeringly high pressures, comparable to those found inside the earth, are in progress at Harvard University. They throw new light on possible geological syntheses of minerals deep in the earth.

By squeezing materials at pressures as high as 700,000 pounds to the square inch and twisting them at the same time, Professor P. W. Bridgman has caused dangerously violent explosions in such substances as celluloid and lead and magnesium dioxide. The explosions are not due to temperature increase, for this was found to be only 34 degrees centigrade.

In addition, Professor Bridgman found that under high pressure plus twisting: (1) Rubber was derubberized into a translucent horn-like material; (2) paper was similarly transformed; (3) wood and linen cloth were changed in comparable fashion.

Control tests on paper, Professor Bridgman adds in his report to *The Physical Review*, indicate that the 700,000 pounds to the square inch pressure will not, of itself, cause the transformation. The twisting or torque is also necessary.

The theory behind the experiments, Dr. Bridgman states, was that if atoms and molecules of substances could be made to slide over one another while under very high pressures they would take up new positions permanently and hence create new and different materials.

"The permanent transition from graphite to diamond was an attractive possibility, made plausible by the fact that the diamond structure can be approximately obtained from the graphite structure by a shear and an axial compression," Professor Bridgman said. The change occurred but was not permanent.

A difficulty of the work, Professor Bridgman pointed out, was to determine, with the very small amounts of materials available, whether any permanent change had occurred. Various organic dyes were therefore squeezed and twisted to see if color changes might occur. With the dye thymol blue there was no color change, but there was a striking decrease in its solubility. Lead dioxide was next tried, on the theory that the color change between lead oxide and the dioxide might be noted. Dr. Bridgman states to his great surprise lead dioxide detonates violently, leaving a residue of metallic lead.

The first attempt at synthesis was the combination of copper and sulfur. "The results were at once positive; there was a detonation at pressures of 20,000 (280,000 pounds to the square inch) without rotation, and the product was apparently the ordinary black sulfide." Some of the explosions were so great that half of the steel pistons used in creating the pressure were blown away.

Technically, the ability of a substance to assume several different forms, as was found in Professor Bridgman's experiments, is known as polymorphism. Of the significance of his tests he concludes: "Polymorphism may be expected to be a common phenomenon under the high pressures in the interior of the earth. The volume changes

associated with polymorphic transitions combined with the greatly enhanced shearing strength under pressure of practically every substance must afford opportunity, at least locally and temporarily, for the development of high shearing stresses in the interior of the earth, under the action of which novel chemical reactions may well occur.

EFFECT OF THE SUN'S ERUPTIONS ON RADIO TRANSMISSION

RADIO transmission on certain short wave-lengths was wiped out by eruptions of the sun for a single day, October 24, according to a statement made by the National Bureau of Standards. The fade-out shed new light on the complex and baffling relation between radio transmission, sun-spots and magnetic storms.

Radio wave-lengths like those used by home radio receivers were not affected, but experimental radio transmission below certain short wave-lengths was completely wiped out. Commercial and amateur radiograms sent on the short wave-lengths were also seriously hampered.

Dr. J. H. Dellinger, chief of the radio section of the bureau, recently suggested in *SCIENCE* that the days from October 21 to 25 be watched for just such a fade-out happening. The October dates fitted in with his previous observation of an approximate 54-day cycle based on severe fading on March 20, May 12, July 6 and August 30.

"The occurrence of October 24," according to the report of the Bureau of Standards, "was a wiping out of radio transmission above a certain frequency throughout the daylight hours of the day in question."

The report adds: "At the time of a radio fade-out, there is doubtless some eruption on the sun much more sudden than the growth of a sun-spot, which abruptly changes the rate at which the sun sends certain waves or particles into the earth's atmosphere. Such eruptions produce magnetic disturbances also. There has hitherto been no way of identifying particular magnetic disturbances associated with such eruptions. The radio effects, on the other hand, are easily identified, and further study of them may furnish a means of closer insight into the mysteries of magnetic disturbances and other effects closely related to events on or in the sun."

Just prior to the fading there was a remarkable increase in sun-spot intensity starting on October 10. On the same date also there began a general improvement in radio transmission on high frequencies. By October 21 to 23 the upper limit of frequency was the highest value ever observed at the bureau. Then on October 24, for the single day, conditions completely reversed. On October 25 they returned to their former high values. The reversal was also accompanied by a remarkable change in the height of the upper ionized layers of the atmosphere which reflect radio waves. Prior to and following October 24 the height of this layer was 150 miles. During October 24 it was 290 miles.

Professor Henry G. Gale, of Mount Wilson, reports that a close relationship between the disappearance of the short-wave radio signals and solar activity was found at

Mount Wilson Observatory. Special observations were made of the sun from October 21 to 25. On the morning of October 24 a group of dark granular flocculi was observed on the sun's disk, but hardly large enough to be classed as a sun-spot. Photographs using only light from hydrogen atoms in the sun were then taken every fourteen minutes throughout the day. Later in the morning the size of the group increased greatly until it was the largest object on the sun's surface as observed by the hydrogen spectroheliograph. Finally in the evening the size of the solar object returned to its former value. The increased solar activity paralleled the strange radio fade-out. Technical details of the fading are given in the issue of *The Physical Review* for November 15.

VACCINATION AGAINST INFANTILE PARALYSIS

SCIENTIFIC opinion on the value and safety of vaccines for infantile paralysis is sharply divided, it appears from discussions at the meeting in St. Louis of the American Public Health Association, Southern Branch.

Is it safe to inject some of the active, living virus of the disease into a child's body, even if the virus has been weakened so that a large dose of it does not produce paralysis in monkeys? Does it do any good to inject doses of dead virus?

Parents and physicians all over the country are anxious to know the answers to these questions. So far, scientists have not agreed and from the discussions here it appears that the question can not be settled without much more extensive researches.

Disappointing results were obtained with the trial of the dead virus vaccine in last summer's epidemic of infantile paralysis in North Carolina and Virginia, because the trial proved nothing either for or against the vaccine.

The North Carolina test was made on 1,452 children, according to the report of Drs. A. G. Gilliam and R. H. Onstott, of the U. S. Public Health Service. These children were nearly of the same age, had equal chances of being exposed to the disease, and were children whose parents wanted them vaccinated in order to protect them if possible against the epidemic in the vicinity. They were divided impartially into two groups. All the children in one group, 458, were vaccinated with dead virus vaccine prepared by Drs. William H. Park and Maurice Brodie, of the New York City Health Department laboratories. The other children who did not receive the vaccine served as controls, to show whether those protected by the vaccine had any better chance of escaping the disease than those not so protected.

"No cases of poliomyelitis were reported in any of the 1,452 candidates and hence no conclusions concerning the efficacy of the vaccine can be reached from this study," Dr. Gilliam said. The study was carried out under the supervision of Dr. J. P. Leake, medical director of the U. S. Public Health Service.

It would be necessary to vaccinate 10,000 children and have 10,000 controls under conditions like those of this particular trial, to show conclusively the value of a perfect vaccine against infantile paralysis, Dr. Gilliam said. If the vaccine were only 80 per cent. effective, a total of 40,000 children would have been necessary.

Further trials of this vaccine are contemplated by Drs. Park and Brodie. Although some investigators hold that dead virus vaccine can not produce immunity or resistance to infantile paralysis, Drs. Park and Brodie reported they had found "anti-bodies," substances they believe indicative of immunity, in the blood of children vaccinated by their method.

Dr. John A. Kolmer, Research Institute of Cutaneous Medicine, Philadelphia, reported that vaccine, made of living virus weakened by chemical and other treatment, has been given to over 10,000 children. Ten of these children subsequently contracted the disease, five of them dying of it. Dr. Kolmer believes this was because they were already infected before they received the vaccine, and that it was given too late to prevent the onset of the disease. None of these ten children received the full doses which he considers necessary for full protection. Other investigators, skeptical of the safety of injecting living virus, see in these ten cases confirmation of their doubts and consider Dr. Kolmer's vaccine unsafe.

Hope that satisfactory vaccines will eventually be developed for protection against virus diseases, such as infantile paralysis, was expressed by Dr. Thomas M. Rivers, of the Rockefeller Institute for Medical Research, New York. Dr. Rivers pointed out the many difficulties in the way of developing such vaccines, difficulties due to the different behavior of viruses and to insufficient understanding of them at present.

GRASS GROWING AS A REMEDY OF SOIL EROSION

GRASS, growing in thousands of fields worn and tired from too much crop-bearing, will be the salvation of the soil and hence of the farmers that depend on it, Administrator Chester Davis, of the AAA, declared in an address before the meeting, in Washington, of the National Association of Land Grant Colleges. By reversing the forest-cutting, sod-breaking practices of tradition, where these have been carried to land-killing excess, by inviting the sod to return where it is needed, the present menace of erosion can be averted, he told his listeners.

No real blame can be fastened upon farmers of either past or present for the dangerous state of things that exist, Mr. Davis said. The pioneers acted instinctively, in their zeal to clear the land; the farms had to be won from the wilderness.

The present generation of farmers, who abandoned their crop-rotation systems and plowed up grassland that should have stayed under sod, knew that they were doing evil things; but they could not help themselves. With post-war low prices for farm products, and post-war high prices for industrial wares the farmer had to buy, he had no choice but to raise more bushels of corn, more bales of cotton, even at the cost of damage to the land.

Mr. Davis dramatized the situation: "The tillers of the soil became miners of the soil. Our pioneers became prospectors—prospectors digging desperately into the soil for all they could mine to-day regardless of to-morrow, even though the best they could get out of it was not enough to enable them to live the life their pioneer fathers had in mind when they won the West and plowed the prairies for them."

The retirement of surplus-producing acres, the helping of the farmer through the much-debated processing taxes, Mr. Davis held justified even without the support of the argument that it brought direct cash benefit to the distressed farmers, because it has made possible beginnings of scientific land restoration through return of erosion-checking permanent grass, and the planting of legumes to rebuild soil fertility.

UNIVERSITIES AND THE APPLICATIONS OF SCIENTIFIC RESEARCH

UNIVERSITIES should keep in closer touch with the world's needs for the products of scientific research, Dr. William Charles White, chairman of the division of educational relations of the National Research Council, recommended in an address before the meeting, in Washington, of the Association of Land Grant Colleges. As things stand at present, much research fails to be used efficiently, and, on the other side of the picture, many pressing problems drag along unsolved because they are not called to the attention of the right groups of men working in the right laboratories.

"I should like to suggest in this connection," said Dr. White, "that there should be attached to each university in the office of the president an officer, known as the correlator, whose function would be to attend all conferences with the purpose of uniting our great industries and our universities for the welfare of the public and to advise the president as to the steps that may be taken in the university for the provision of graduates for future special fields of endeavor."

As concrete examples of special interest to land grant college executives, Dr. White pointed out several fields of investigation looking to the industrial utilization of farm products and wastes, and the introduction of new crops of use mainly in industry. Such are the growing demand for industrial alcohol produced from surplus grain, fruit, potatoes, etc., and the absorption of large quantities of soybean oil in the manufacture of varnish, enamel and plastics.

However, the possibilities of more efficient research envisioned by Dr. White are not all in the field of immediate application in industry and engineering. There are many lines of research in fundamental science that need even more intensive investigation than they are receiving at present, and many problems on the "borderlands of science" that have as yet hardly been attacked at all.

An experimental approach that has been made with considerable success by four of the country's great universities was cited by the speaker. Each of these universities asks itself "what its objective is in relation to its environment, national work, and possible special value so far as may be seen into the future." Having set this objective, it begins analysis of its departments with a view to attaining this goal.

ITEMS

VERY hot stars, with surface temperatures around 40,000 degrees, have provided the latest evidence in favor of the Einstein relativity theory. Dr. Robert J. Trum-

pler, of the Lick Observatory, has found that the lines appearing in the spectra of those stars after their light had been analyzed through the prisms of a spectroscope, are shifted towards the red. This shift is greater than that shown by other stars closely associated with the hot ones. In a paper published in the current issue of the *Publications of the Astronomical Society of the Pacific*, Dr. Trumpler expresses the view that this shift is similar to one found previously in the sun and other stars, and which was predicted by Einstein. It is believed to be due to the fact that the light waves are lengthened slightly when they leave such a massive body.

A CHEMICAL cousin of synthetic perfume is now being used in steam boilers instead of water to increase the power output for each ton of coal burned. C. G. Brown, G. A. Gaffert, P. H. Konz and D. S. Ullock, all of the University of Michigan, have just completed tests on the new boiler chemical. Known as Dowtherm A, it freezes near room temperature, 54.7 degrees Fahrenheit, and is a mixture of di-phenyl and di-phenyl oxide. At the high temperatures in steam boilers it yields a steam-like vapor but develops much less pressure than steam—a decided advantage. The substance is related chemically to synthetic geranium perfume and to certain of the synthetic resins used in making plastic products.

SHELTERBELT tree plantings in the Plains area are to be made in future from seedling descendants of trees already growing in the region and used to conditions there. At a meeting of biologists, in Washington, Paul H. Roberts, of the U. S. Forest Service, told of a 1935 harvest of 57 tons of seeds and fruits of various Plains tree species, enough to supply 100,000,000 young trees for shelterbelt plantings. Of this quantity, 85 per cent. came from trees in the shelterbelt area, 10 per cent. from trees in immediately adjacent regions in the West, and 5 per cent. from other sources, chiefly Chinese elm, a species claimed to be especially well adapted to cultivation in the West. During the first shelterbelt planting season, just closed, 125 miles of shelterbelt were set out, besides 5,000 acres of farmstead tree plantings. Much of the stock, secured on an emergency basis from private nurseries, was not as suitable to the purpose as might have been desired, Mr. Roberts said, but even so, between 70 and 85 per cent. of the plantings have survived.

RESEARCH conducted jointly by the antarctic research ship, *Discovery*, the British Museum of Natural History and the London National Institute for Medical Research, show that a female sex hormone, known as progesterin, and widely used in gynecological practice can be obtained as a by-product of the whaling industry instead of from sows killed in slaughter houses. The hormone, surprisingly enough, can be obtained under ordinary whaling conditions and can be preserved in formalin for many months. Authorities in London believe that the hormone from whales will be widely used, at least until the hormone can be produced synthetically on a commercial scale. Progesterin is produced by the corpora lutea of the ovaries. Besides playing a secondary sex-stimulating rôle, it prepares the uterus for reception of the fertilized egg and pregnancy.

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By ARTHUR H. COMPTON

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SCIENCE NEWS

Science Service, Washington, D. C.

LITHIUM FLUORIDE CRYSTALS

A SCIENTIFIC discovery that holds promise of contributing to important research into the atomic structure of matter became known when Professor Donald C. Stockbarger, of the Massachusetts Institute of Technology, announced that he has successfully grown in his laboratory large and optically perfect lithium fluoride crystals.

Lenses made from such crystals, because they transmit light over a wider range of wave-lengths than any known optical material, are expected to be a powerful new tool for science. Natural crystals of this kind are usually too small for satisfactory use in lenses, and previous attempts to grow large ones artificially have been unsuccessful.

Formal announcement of the artificial synthesis was made by Professor Stockbarger at the recent meeting of the American Physical Society in Baltimore. Several of the new crystals, including one three inches in diameter, were exhibited.

Lithium fluoride transmits light waves from the infra-red region through the visible part of the spectrum but farther into the ultra-violet bands than other substances. Prime use of lithium fluoride crystals, in fact, should be in studies of the ultra-violet region of the spectrum.

In addition to its use in the ultra-violet, lithium fluoride should aid in research in the visible range, for its bends the various colors of the spectrum far more equally than other materials. Thus, images made by lenses of this substance are less subject to color fuzziness around the edges, which necessitates the use of compound lenses to offset this effect when glass or quartz lenses are used.

Crystals of lithium fluoride are also expected to aid science greatly in spectroscopic investigations, particularly in atomic research on liquids and some gases which must be confined in a container which permits the transmission of light over the widest possible range of wave-lengths. Use of microscopes in various phases of research may also be widely extended by using lenses made from these crystals.

The success of this method of growing the crystals lies in the synthesis of lithium fluoride salt in the purest form and the growth of the crystals in a specially designed electric furnace capable of precise temperature control. In this way he expects he will be able to grow crystals even larger than three inches in the future.

The substance is first produced in the form of a powder and then melted in specially shaped platinum crucibles with conical bottoms. After melting, a slow process of cooling is started and a tiny seed crystal forms in the point of the crucible, growing until the entire substance is crystallized. The finished product can easily be cut to the desired size and shape and polished.

IS THE UNIVERSE EXPANDING?

THAT the earth is near the center of an exploding or expanding universe may be just a false concept built up in the mind of man, suggests Professor Fritz Zwicky, of the California Institute of Technology.

When scientists interpret the much-observed red shift of the light from distant nebulae as proof that the separate parts of the universe are rushing away from one another with velocities as high as 15,000 miles a second, they are making only one of several possible interpretations. Dr. Zwicky, reporting in *The Physical Review*, points out that while the theory of relativity partially explains the red shift in terms of an expanding universe, the relativity predictions are not in accordance with observation in several important respects.

The red shift of light from distant nebulae is analogous to the lowering of the pitch of a sound like that from the whistle of a locomotive speeding from the observer at the crossing. In both cases the shift is toward lower frequencies: for the whistle it is sound frequencies; for the expanding universe concept light frequencies are concerned. Lower light frequencies make the observed rays from the distant nebulae more reddened than they really are. The colors are not necessarily red in the observed spectral lines, but merely shifted in the red direction—hence the so-called red shift.

In his complex mathematical scientific paper Professor Zwicky sets up all the requirements which any explanation of the observed red shift must satisfy in order to be acceptable. For one thing, the shift ought to come to be the property of any point in space instead of just that particular corner of the universe around the earth. "We do not want to assume that our earth is just the center of things. The relativity explanation of the red shift satisfies this requirement but so do other theories.

In other requirements the relativity explanation does not meet observed conditions, but Professor Zwicky, in his report, shows how to examine broadly all possible theories and has found, surprisingly, that some theories meet all demands and may be as good as, or better, than the relativity explanation of the red shift.

The selection among the possible alternative theories must be left to checking by observations. Some of them require new developments in astronomical technique such as the installation of the new 200-inch telescope at Mount Palomar for the California Institute of Technology.

ANALYSIS OF SOUNDS BY THE CAMERA

DEVELOPMENT of a "sound camera," which, within a few seconds, automatically makes a picture of the quality of tones and noises within most of the range of human hearing, is announced by Dr. Harry H. Hall, of the Cruikshank Laboratory of Electric Communication Engineering at Harvard University.

With older methods these scientifically important tones and pictures could be made only in several days, but Dr. Hall's new apparatus can make them in less than four seconds. With them the sounds of musical instruments can be studied and minute differences in tone between very fine and just ordinary instruments can be detected and analyzed. Accurate and detailed records of speech sounds can also be obtained with the new camera.

Analysis of a sound by the instrument is made from

picture of the relative loudness of all parts of the sound, including the fundamental pitch, the overtones and incidental sounds such as the scratching of a violin bow. These pictures are in the form of line graphs showing the loudness of each of the component parts of the sound under examination.

All sounds from about 50 to 10,000 cycles can be handled by the instrument, a very satisfactory range in comparison with that of the human ear, from about 20 to 20,000 cycles.

The chief value of the device lies in its amazing speed. A complete picture of a sound can be obtained in 3.78 seconds. This permits thorough and accurate analysis of tones which remain steady for only a short time, such as those of the human voice. Thus the scientist can easily and quickly obtain all the material he needs for a detailed study of sound quality and acoustics.

ANESTHETICS FOR THE TEETH

DR. L. L. HARTMAN, of Columbia University, has discovered a "desensitizer" that does away with the painful sensations during the necessary drilling before a cavity in a tooth can be filled.

The desensitizer which Dr. Hartman discovered after nearly twenty years of research is a colorless fluid. Unlike other anesthetics which must be injected into the nerves or pulp of the teeth, Dr. Hartman's fluid is applied to the dentin, the substance which forms the bulk of the hard part of the teeth. It takes a minute or a minute and a half to take effect and the pain-killing effect lasts from twenty minutes to an hour, giving plenty of time to prepare almost any cavity for filling. There are no unpleasant after-effects and the pulp of the tooth remains normal.

The chemical composition of the desensitizer has not been announced and the fluid is still nameless. Patent rights for it have been assigned by Dr. Hartman to Columbia University. It will be on the market soon, and the quality and price will be controlled by the university in order to make it available for general use and to prevent exploitation of the public.

Human patients had to serve as "guinea-pigs" in the experiments leading to perfection of the desensitizer, since there is no satisfactory way of testing a pain-killer on a laboratory animal.

Discovery of this new kind of anesthetic for use in dental work recalls the fact that dentistry gave anesthetics to the world. Ether anesthesia was first used in the extraction of a tooth before its famous trial for a surgical operation at the Massachusetts General Hospital, Boston, in 1846. William Thomas Green Morton, who gave ether its first public demonstration as a surgical anesthetic, had been a dentist before he studied medicine.

VITAMIN A IN THE RETINA

(Copyright, 1935, by Science Service)

FIRST definite evidence of a vitamin participating directly in a physiological process has been found by Dr. George Wald, of the Harvard University Biological Laboratories, who has conclusively proved that the fat-

soluble vitamin A found in milk and fish liver-oils is present in the retina of the eye and is active in vision.

In the course of this research Dr. Wald also discovered a heretofore unknown yellow pigment which he has named retinene. Like vitamin A, this substance is related to the carotenoids, the coloring matters of many plant and animal tissues. Retinene, he found, is liberated by the action of light on the eye.

For some time it has been known that insufficient vitamin A in the diet results in so-called "night blindness," a lowered ability to see in dim light. Since the retinal rods are used principally in dim vision, it has been believed that the vitamin must be associated in some way with these organs.

The discovery of free vitamin A in the retina tended to substantiate this theory. Dr. Wald has now found that the vitamin participates directly in the formation of visual purple, a pigment contained in the retinal rods. The bleaching of this pigment by light is the initial step in the visual process.

When the visual purple is thus bleached an orange material called visual yellow is formed. This process is accompanied by the liberation of a large amount of retinene, to which the color of visual yellow is due. Following bleaching, the orange color slowly fades, the retina finally becoming colorless. At this point it is found that the retinene has disappeared, having been transformed entirely into vitamin A.

In the living animal the vitamin is re-synthesized to visual purple, completing the cycle. This cycle is not a perfect one, however, since some vitamin A is apparently lost in the process. This appears to be one reason why it is necessary to provide the animal with a continuous supply of new vitamin.

In the original experiments with frogs, Dr. Wald reported observations made principally with a pocket spectroscope. Recently he has been able to obtain objective records of each detail of these results by the use of a recording spectrophotometer, designed by Professor Arthur C. Hardy, of the Massachusetts Institute of Technology.

EFFECTS OF DRUGS ON THE HEART

HEARTS from dead men, revived and brought to life, are giving new knowledge of how to use the drugs that aid heart afflictions. Experiments wherein fresh blood was pumped through dead human hearts until they started beating freely again have been reported by Dr. William B. Kountz, of the Washington University School of Medicine.

The drugs commonly used to treat heart disease may be helpful, or harmful, depending on the state of the heart. In the type of heart disease Dr. Kountz investigated and reported to the Southern Medical Association, the small arteries of the heart muscle itself are closed. Blood therefore can not get through to nourish the muscle and keep the heart at work pumping blood into the rest of the body.

Physicians have lately been treating this heart ailment by giving drugs that would dilate the closed or dangerously narrowed arteries, on the theory that widen-

ing the arteries would help to keep the blood flowing through them. They learned which drugs to use by studying the drug's action on the heart arteries of experimental animals.

The use of the artery-expanding drugs in human cases of heart disease has, however, not been entirely satisfactory, Dr. Kountz observed. His research seems to show why. In human hearts, he found, the state of the heart or the tone of the heart muscle is the chief factor influencing the flow of blood through the heart's arteries.

Dr. Kountz tried the effect of various common heart medicines, such as the nitrites, liver extract, theobromin, digifolin and adrenalin, on the hearts he had revived. Their action on the heart was entirely different when the heart muscle was contracted than when it was relaxed. Nitrites, for example, which ordinarily increase the flow of blood through the heart's arteries, increased it still more when the heart muscle was contracted, but lost their effect entirely when the heart muscle was relaxed.

Dr. Kountz concludes that physicians will know better what drugs to use in treating heart disease if they classify heart ailments according to the state of the heart as far as it can be determined by studies of the patients.

ITEMS

MAUNA LOA, in eruption again, is one of the busiest of the world's volcanoes, but also one of the least troublesome, so far as destruction of human life is concerned. In all recorded history, and through all the traditions of the Hawaiian natives, it has never killed a man, though its lava-rivers have occasionally done considerable property damage. Nevertheless its demonstrations, like all volcanic outbursts, are awesomely impressive. Its last preceding outburst occurred a little less than two years ago, on December 4, 1933. This outbreak had been predicted in 1931 by the well-known government volcanologist, Dr. T. A. Jaggar. He foretold an eruption as due within three years, and Mauna Loa "came through" with a liberal time-margin to spare. During the period of slightly over a century since the white man's history of the islands began, there have been about thirty eruptions of Mauna Loa. The mountain is the loftiest peak of the islands, and one of the notable cones of the entire world, with an altitude of approximately fourteen thousand feet.

THE official altitude figure of 72,395 feet (13.7 miles) for the highest up of the National Geographic Society-U. S. Army stratosphere flight of November 11, just determined by National Bureau of Standards calibration of the sealed meteorograph, is a record that will probably stand for some time. It is higher by not quite a mile than the unofficial figure for the ill-fated Soviet balloon of 1934 that crashed in landing with fatal results to its crew of three. It is more than 2 miles (11,158 feet) higher than the official record set in 1933 by the Settle-Fordney American flight, the official mark of which was 61,236.691 feet. The routine flights of instrument-carrying balloons used in weather observations do not often reach higher than the new record for man-carrying strato-balloons just announced. Sounding balloons, or small balloons that do not carry anything but themselves aloft,

often go higher than the new world's record. The American record for these sounding balloons dates from 1913 and is 20 miles. The highest claimed is 22 miles in Germany, but there is doubt about these records, as there are theoretical reasons for doubting whether balloons can rise much beyond about 19 miles. Rockets seem to be the most promising in attempts to probe farther out in space.

SURVIVING conditions where man would die, tiny spores of important plant diseases are growing in a laboratory of the Department of Agriculture, in Washington, after journeying nearly 13½ miles into the stratosphere with the balloon *Explorer II*. Discovery that spores can still live after being sent to an altitude of 72,395 feet is the first scientific conclusion from the recent ascension sponsored by the National Geographic Society and the U. S. Army Air Corps. The spores carried aloft by Captains Albert Stevens and Orvil Anderson to a new world's record had to withstand: (1) Temperatures lower than 65 degrees below zero Fahrenheit; (2) such a low atmospheric pressure that man could not live in it; (3) ultra-violet rays from the sun which never reach the surface of the earth and which are capable of killing some forms of life; (4) ozone; (5) extreme dryness.

COSMIC rays, no longer the mystery they once were, are now used as highly valuable working tools in the scientific laboratory. Their newest use is to help investigate the nature of magnetic forces inside a magnet, according to papers presented before the Baltimore meeting of the American Physical Society. The nature of such internal magnetic forces has been almost impossible to investigate hitherto. The forces outside the magnet could be studied with great precision, but what was happening inside the magnet remained a mystery. High speed and piercing cosmic ray particles, however, are capable of passing through great thicknesses of iron. By seeing how much their paths are bent in going through the magnet, physicists are now able to acquire knowledge of the magnetic field strength in the magnet's interior. The technique is similar to the way one might estimate the force of a hurricane storm by the extent to which a ship has been driven off its course. Two reports describing the theory and experimental studies were presented to the society by Professor W. F. G. Swann, of the Bartol Research Foundation, and his colleague, Dr. W. E. Danforth.

IN spite of the increase in automobile deaths in the United States, accidents cost no more lives now, in proportion to the population, than they did in 1900. Deaths from railroad and street car accidents, drowning, burns, poisonous gas, food poisoning and suffocation, have dropped from an average of 47.7 per 100,000 population during 1900-1905 to 17.9 during 1931-1934, an improvement of 29.8. The rate from automobile accidents was practically zero in 1900 and 28.4 in 1934. The one about balances the other. One out of every 13 deaths in Illinois is due to accident, and more than one third of these are attributed to the automobile, according to a bulletin sent out by the Illinois Department of Public Health. Out of 6,928 fatal accidents last year, 2,576 were caused by motor vehicles. Accidents are now a greater hazard than any disease, except heart disease, cancer and nephritis.

SCIENCE NEWS

Science Service, Washington, D. C.

THE NEED FOR SCIENTIFIC RESEARCH IN AGRICULTURE

SCIENTIFIC research needs greater freedom, less regimentation into separate water-tight compartments, if it is to produce the maximum practical benefits. This idea is laid down as basic doctrine for his department by Secretary of Agriculture H. A. Wallace, in his annual report.

Secretary Wallace writes: "The principal function of this department is scientific research. All its other activities, such as weather and crop reporting, the eradication or control of plant and animal diseases and pests, the administration of regulatory laws, highway construction and economic guidance, are the practical expression of research results. Research is the primary thing, the key-stone of the entire structure of the department's functions and services.

"Naturally the department does not rely exclusively on the findings of its own investigators: on the contrary, it draws upon the general fund of scientific knowledge as it increases throughout the world. But this is one of the tests of its scientific efficiency and value. Were the department not engaged itself in creative scientific work, it could not use creatively the findings of other institutions. Only science can assimilate science."

As illustrations of the way science overflows artificial departmentalizing, Secretary Wallace cites the dependence of aviation, farming and the shipping industries on the Weather Bureau, which itself must invoke the aid of physics, geology, geography and other sciences. He also calls attention to the far-reaching effects of the food-preserving industries on changing types of farming; these industries being the product of joint effort on the part of chemists, physicists and biologists. Examples might be multiplied without end.

Yet in the past, appropriations for the support of research in the Department of Agriculture have allocated funds, "item by item, on a bureau basis, for objects sharply particularized."

To get away from this difficulty, and to push ahead faster toward practically usable results, the department is making use of a special fund for basic research, appropriated by the Congress at its last session. This fund, which will grow to an annual total of \$5,000,000, is partly under the immediate direction of the secretary, to be disposed for the general good of agriculture and of science.

SEARCHLIGHTS TO EXPLORE THE UPPER AIR

(Copyright, 1935, by Science Service)

A NEW method of discovering what exists in the unexplored upper air beyond the reach of balloons, some 20 to 50 miles above the earth, has been developed by three Washington physicists connected with the Carnegie Institution's Department of Terrestrial Magnetism and the Bureau of Chemistry and Soils of the U. S. Department of Agriculture.

Searchlights will be used to shoot light into the night sky, light that is "fingerprinted" by being interrupted at a given frequency using a "light-chopper," so that when it is scattered by the upper air and picked up by large mirrors it can be recognized by tuning the observing instruments.

From what happens to the light in the greatest unknown region of the upper air will come the answer to some questions that science is eagerly asking.

How the thinning air's density varies with height some thirty miles above the stratosphere, in the regions known as the "ozonosphere" and the "altotroposphere," will become known. This is important basic information now lacking.

The research team that has taken the first steps toward conquest of the region between where the stratosphere leaves off and the aurora begins to be born, consists of Dr. M. A. Tuve and Dr. E. A. Johnson, of the Carnegie Institution of Washington, and Dr. Oliver R. Wulf, of the U. S. Department of Agriculture. They gave the first hint of their researches in a short letter published in the current issue of *The Physical Review*.

So far tests have been confined to an artificial light in the laboratory, but field tests are being organized, probably with the aid of large Army-type searchlights of great brilliance. Just one large searchlight is expected to furnish enough light for the experiment, thanks to the device of using "chopped" light.

Once the delicate instruments are put into use analyzing the scattered "fingerprinted" light gathered by the mirror, it is expected to solve other numerous problems, connected with water vapor, turbulence, winds and dust, as well as the chemical state of the rarefied atmosphere that allows it to shine with fluorescent light at times.

In no other way can science adequately probe the region 20 to 50 miles above the earth. Man-carrying balloons' "highest up" is the 14 miles of the recent stratosphere flight. Unmanned balloons can reach only about 20 miles altitude, the top of the stratosphere. At about 60 miles above the earth there is found the base of the auroral displays and the first of the ionized or electrified layers that reflect radio waves. The region between stratosphere and the altostratosphere, which begins at about 60 miles, can be probed with no means so far suggested except the modulated Tuve-Johnson-Wulf light.

Using light as a probe was originally suggested about five years ago by Dr. E. H. Synge, of England, who wanted the Army and Navy to assemble several hundred searchlights and focus them on one place in the upper air. The tests described above, however, indicate that by using "fingerprinted" light even better information should be obtained with a single searchlight aimed at the sky.

STUDY OF THE ATOM

AN important inhabitant of the universe has sat for his portrait. Two very different and conflicting can-

vasses, painted in scientific terminology, have resulted. Neither the sitter (the atom to scientists) nor the artists, who are the physicists studying the composition of matter, are worried much about the conflict.

"Modern physics, instead of deciding between them, links them with the help of the statistical method," explained Dr. Edward Teller, the Hungarian theoretical physicist, who is visiting professor of physics of the George Washington University.

Using mere figures of statistical theory as a microscope with which to view the atom is necessary because the idea that it is indivisible is a paradox, contradicting our ideas gained from everyday experience. Moreover, Dr. Teller observes, atoms can be probed only with other atoms used as tools, so that actions of individuals can not be determined.

The compromise picture of the atom painted by mathematics is still opposed by some of the best physicists, Dr. Teller said, but the drastic procedure is accepted by most because it is successful and the philosophy of its method is satisfying. Studying atoms in bulk instead of trying to understand the behavior of individual atoms has also given information about average actions of atoms and thus it is possible to understand properties of matter as a whole.

THE PREVENTION OF GAS EXPLOSIONS

SMOTHERING dangerous vapors to the point of suffocation is the latest method of preventing dangerous gas explosions in mines, homes and factories which has been developed by scientists at the U. S. Bureau of Mines at Pittsburgh, Pa.

Inert, non-combustible carbon dioxide and nitrogen gas are the smothering agents used to prevent disaster in gas lines, gasoline tank cars and storage holders.

In air-tight rooms in the Bureau of Mines laboratory various gas burners were lighted and allowed to run until their flame was extinguished from lack of oxygen. By analyzing the oxygen content of the room at this time the critical percentage of oxygen was determined below which combustion could not occur. From 10 to 12 per cent. of the normal oxygen content was found sufficiently low for safety.

With this knowledge the suffocating and diluting carbon dioxide and nitrogen gases were then pumped into the air-tight room, containing an explosive mixture, until the oxygen content was lowered to the critical non-combustion supporting stage. Again the flame would not burn. The discovery should find use as a precautionary measure in closed places, with a great improvement in safety.

STEAM AND OIL-BURNING DIESEL LOCOMOTIVES

WITH the fate of millions of dollars' worth of new railroad equipment at stake, the race between steam and oil-burning Diesel locomotives reached a new peak in 1935, it is indicated in the progress report presented by a committee of the American Society of Mechanical Engineers at its fifty-sixth annual meeting in New York City.

Steam, the old stand-by of railroad propulsion, brought out fifteen new locomotives either stream- or semi-streamlined for sustained high speed. Three new Diesel-driven locomotives were put into service during the year, while twelve light-weight Diesel-electric articulated trains went into operation.

Steam-driven trains ranged from the crack "Hiawatha" of the Chicago, Milwaukee and St. Paul to the "Asia," built in Japanese railroad shops, running between Dairen and Hsinking in Manchukuo. Diesel locomotives included those for the Union Pacific's "Super Chief," and the Baltimore and Ohio's "Royal Blue" and "Diplomat." In the light-weight, high-speed field were the four "Zephyrs" of the Burlington, the New York, New Haven and Hartford's "Comet," and the first of the southern flyers, the "Rebels" of the Gulf, Mobile and Northern.

In Germany, where high-speed light-weight articulated trains started, the original "Flying Hamburger" has two new colleagues, the "Flying Frankfurter" and the "Flying Koelner." More significant in Germany, however, was the arrival of three streamlined steam locomotives capable of pulling full-weight heavy trains at 110 miles an hour.

THE HOSPITALIZATION OF TUBERCULOSIS PATIENTS

THE most complete data ever obtained on the hospitalization of tuberculosis patients in the United States is presented this week in the *Journal of the American Medical Association*.

The survey shows that American sanatoriums, or hospitals for the tuberculous, provide beds for 95,198 patients and are on the whole fine institutions. Sixty per cent. of their patients are definitely improved by the treatment given. These special hospitals represent an investment of \$330,000,000, including land, buildings and equipment. Veterans' hospitals for the tuberculous cost on the average \$4,000 a bed. In most other institutions, both private and public, the cost per bed is less, but there are extremes in variation.

Elaborate plants and expensive equipment bring the cost of some tuberculosis hospitals as high as \$10,000 a bed. One sanatorium built with public money cost \$13,043 a bed.

The use of tuberculosis departments in general hospitals has been endorsed by the American Medical Association, the American Hospital Association and the National Tuberculosis Association. The endorsement, however, requires adequate segregation for the protection of other patients and personnel.

In a few of the sanatoriums, the survey revealed, adults and children are allowed to associate in various ways. In a few cases, too, it was found that children with tuberculosis of the lungs were hospitalized with children in the preventorium unit. That such conditions call for prompt correction is made plain in an editorial commenting on the survey.

No attempt was made to give a relative rating to the individual institutions. The comment that would characterize the tuberculosis institutions of the United States

in general would in most cases be commendatory, according to the council on medical education and hospitals of the association, under whose direction the survey was made.

IMPROVEMENT OF MEMORY BY SLEEP

If a person memorizes certain kinds of material perfectly, and goes to sleep immediately afterwards, he will recall more of it, and also re-learn the whole task more economically after a lapse of 24 hours, than if he waits even a few hours before he goes to sleep, according to Dr. H. M. Johnson, professor of psychology of American University, Washington, D. C., who spoke at Cornell University recently.

Experiments based on different methods, made by Dr. Rosa Heine Katz, at the University of Göttingen, and by Joseph F. O'Brien, graduate student at American University, showed that all the subjects who were studied were better able to recall and also to re-learn material that they had learned by rote and partially forgotten, if they first slept for eight hours and then worked for 16 hours, than if they distributed their rest and activity in any other way during the 24-hour period.

Dr. Johnson said that the differences in favor of sleeping immediately varied between 20 per cent. and 30 per cent., according to the subject and the task. One would be justified in offering a bet of 100,000 to one that Mr. O'Brien's results were not due to chance.

Two explanations have been offered. One, which Dr. Johnson called the "hardening" hypothesis, pictures the brain as inert during sleep, giving recently received impressions a chance to become "set." The other, called the "reverberation" hypothesis, regards the brain as an active organ even during sleep, and supposes that it goes on repeating or "reverberating" recently received impressions during the unconscious period.

Dr. Johnson does not regard either hypothesis as satisfactory. The "hardening" hypothesis is cast into doubt by the poor recall of memorized material made by persons who had "hardened" their brains with the equivalent of only one highball. Furthermore, very recent studies on brain waves show that these fluctuations in the electric potential of the brain go on continuously during sleep, though not in their ordinary "waking" patterns. Finally, studies on sleep, conducted by Dr. Johnson himself several years ago at the Mellon Institute, show that sleepers assume muscular positions which they can maintain only by dint of strenuous brain exertion.

Dr. Johnson offered a third hypothesis which, however, he did not urge as necessarily correct. He suggested that the memorized material might "reverberate" in the brain, but during the drowsy periods before sleep and during the slow awakening process, and also during the frequent half-wakeful periods during the night which most persons experience without realizing or remembering them.

ITEMS

WORKING models of industrial plants for the extraction of soy-bean oil and the production of power alcohol from Jerusalem artichokes are among the highlights of the

exposition of chemical industries held recently in New York. Exhibited by the newly-formed Farm Chemurgic Council, the models demonstrate the way raw materials raised on America's farms can be utilized for purposes other than for food. From the soy-bean oil new types of plastic materials can be fabricated, which have applications in automobiles and in other industries. The new explosive, nitramon, for use in quarrying and mining, is shown publicly for the first time. Seventy-five per cent. as violent as dynamite, the new material comes in sealed cans which may be dropped, heated with a blow torch or pounded with a sledge hammer without exploding. Special fool-proof equipment must be used to make it explode.

KILAUEA, companion volcano to the erupting Mauna Loa, is being closely watched by scientists of the National Park Service in Hawaii National Park. Both volcanoes are within Park boundaries. Kilauea has long been suspected of having some kind of deep under-earth connection with Mauna Loa, though their greatest activities have not always been simultaneous. Like Mauna Loa, Kilauea is a relatively harmless volcano, venting its energies in rather frequent quiet lava flows rather than storing up back pressures and finally exploding in a great destructive burst. Kilauea differs from Mauna Loa, however, in that it is a wide, low, "shield" volcano without a pronounced cone, whereas Mauna Loa has a tremendous towering peak nearly 14,000 feet high. There has been a fresh flow of lava from a new vent within the past few days, but it is thought that it is quite unlikely to reach Hilo, the largest town on the island.

A CAVE where Ice Age cave bears lived, where Ice Age cave men pursued and killed them, and took over the den as their own dwelling while they gnawed their bones, has been discovered and explored in Schleswig, by Dr. Lothar F. Zotz, curator of prehistory of Breslau. Many of the bones and teeth of the monstrous bears found in the cave have been worked over into implements and utensils, and there are abundant charcoal remains of the old hunters' fires. This cave, Dr. Zotz says, is the first of its kind to be found in northeastern Germany.

DEEPER than the Grand Canyon of Arizona, and very risky to navigate, the Canyon of the Salmon River in Idaho has been explored for the first time under the auspices of the National Geographic Society. Parties of hunters, miners, etc., have in the past made the trip, but until now no systematic attempt has ever been made to record the geology and natural history, or to obtain a full series of photographs of the canyon. The exploring party found Indian paintings of men and animals on the rocks, discovered several hot springs, and saw great numbers of deer, wild goats and grouse. The Salmon has been nicknamed the "river of no return" because when a party wishes to undertake the hazardous trip down its canyon the only practicable method is to purchase a heavily built scow at its upper end, drift down the river, and sell the clumsy craft at the lower end. The upstream trip has never been attempted.

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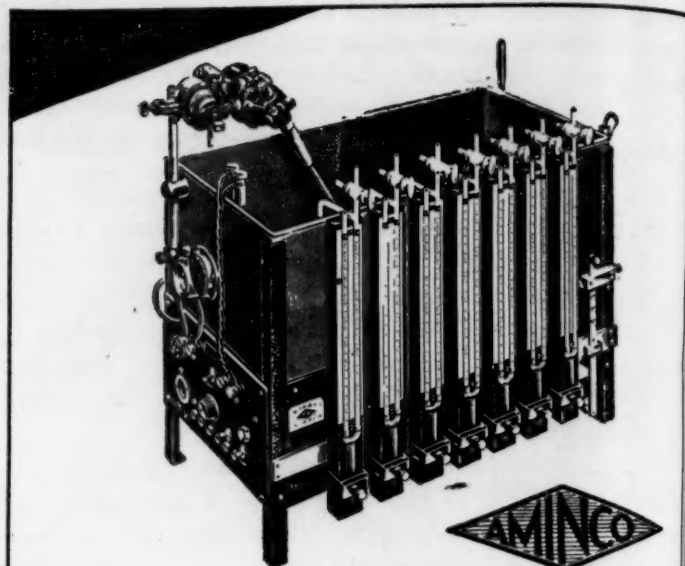
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UNIVERSITY OF CHICAGO PRESS. *Books for Fall 1935.* Pp. 16. Illustrated.

P. J. KIPP AND ZONEN, Delft, Holland. *Section G-33: Galvanometers, Photographic Recording Apparatus, Galvanometer Accessories.* Pp. 46. 36 figures. *Spectrographs.* Pp. 4. 3 figures. *Standard Thermopiles of Moll and Burger.* Pp. 4. 5 figures.

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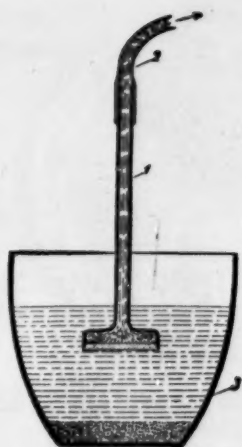
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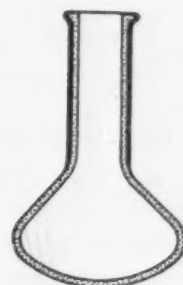


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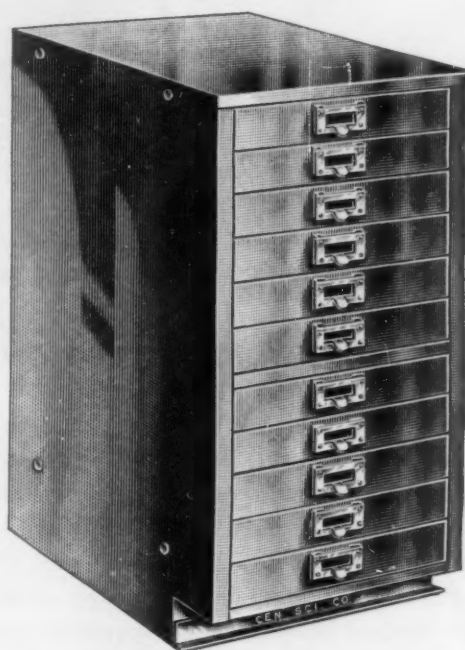
THE symbol of coordinated research and engineering in every field of radio; the mark of technical excellence on the equipment of complete radio systems, from the microphone in the studio to the radio receiver in the home.

RADIO CORPORATION OF AMERICA
RCA Building

30 Rockefeller Plaza

New York

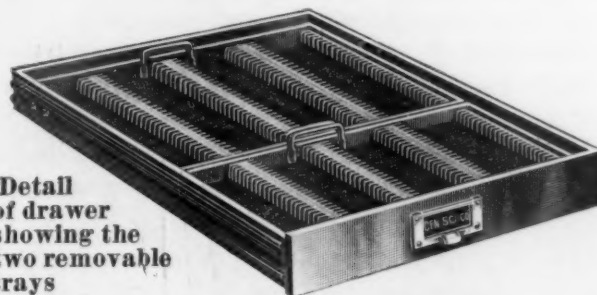
A Really Convenient MICROSCOPE SLIDE CABINET



CENCO ELEVEN-DRAWER UNIT
Capacity 10,032 slides

EACH drawer holds two trays having a capacity of 456 slides each. The slides are held vertically by grooved metal divider strips. The tray bottoms are lined with felt. The cabinet is constructed of steel and finished in olive-green enamel with chromium-plated trim. Over all dimensions: Height, 33½ inches; width, 16½ inches; depth, 24 inches.

66467. **SLIDE CABINET,**
Cenco, complete with
trays Each \$165.00



Detail
of drawer
showing the
two removable
trays

CENTRAL SCIENTIFIC COMPANY
LABORATORY TRADE MARK SUPPLIES
Apparatus REGISTERED Chemicals
NEW YORK - BOSTON - CHICAGO - TORONTO - LOS ANGELES

OTTO H. A. SCHMITT**Department of Zoology, Washington University**

A portable universal unit for the measurement of nerve potentials. The cathode-ray oscillograph sweep circuit is synchronized entirely by vacuum tubes and stimulation is by thyatron. By an auxiliary device DC potentials may be measured also.

SCIENCE IN CITY PLANNING

Rapidly changing characteristics of American cities have brought about the new science of city planning. The City Plan Commission of St. Louis will present an exhibition of technical studies developed as part of its program for analyzing existing conditions, major trends and suggestive plans and controls designed to bring about stability and balance in the gradual development of the city structure.

SMITHSONIAN INSTITUTION**C. G. Abbot, Secretary**

A solar heating element, comprising a mirror of parabolic cylindric curvature 2 feet \times 68 inches, focusing parallel rays on a vacuum-jacketed heater tube. Within the tube is an opaque liquid boiling at about 350° C. By suitable insulated pipes the liquid is caused to circulate through a reservoir at higher level. For exhibition purposes four electric lamps are arranged to send 12-inch parallel beams upon the mirror. The available heat concentrated within the opaque liquid is used to heat water within the reservoir. From results of solar experiments it is computed that a suitable outfit of this type can convert 15 per cent. of intercepted solar energy into mechanical work through a steam engine. There will also be an exhibit by F. H. H. Roberts, Jr., of stone implements belonging to the Folsom complex, the oldest known archeological material yet found in North America.

SPENCER LENS COMPANY, BUFFALO, N. Y.**Booth No. 7**

Demonstration of the latest developments in microscopes, microtomes and projection apparatus. The company's representatives will show the advantage of the low fine adjustment; binocular bodies with converging tubes; the newest petrographical and chemical microscopes and accessories for scientific laboratory workers.

THE STANDARD ELECTRIC TIME COMPANY, SPRINGFIELD, MASS.**Booth No. 100**

An exhibit of (1) synchronous, motor-operated electric stop clocks for manual or automatic interval measurements, such as psychological reactions, viscosity tests, cycle counting, etc. Numerous models show wide adaptability; (2) the application of photo cell to precision timing will be demonstrated in calibration of electric meter standards or portable time pieces; (3) laboratory electric panels for research and teaching.

UNIVERSITY PRESSES**Booths Nos. 29 and 30**

There will be a cooperative display of scientific and technical books by the following presses: Harvard University Press, Oxford University Press, Stanford University Press, Columbia University Press, University of

Minnesota Press, University of Pennsylvania Press and University of Chicago Press. Studies reporting the latest research in chemistry, geology, botany, physics, astronomy, mathematics and psychology will be displayed on the shelves; also scholarly and scientific journals which are published by the above-named university presses. The University of Chicago Press will exhibit their recently published "new-plan" texts designed for the introductory general course in science at the college level. The University of Minnesota Press will have a display of their new publication, "Algae and Their Life's Relations" by Tilden.

W. M. WELCH SCIENTIFIC COMPANY, CHICAGO**Booth No. 34**

Electron display: Demonstration of Millikan oil drop experiment, special electroscopes and condensers, new Thorium decay apparatus, Hoag's $\frac{e}{m}$ apparatus and new x-ray absorption screen and Echelon filters. Special vacuum equipment: New Duo-Seal triple stage rotary oil seal pump, capacity in excess of thirty liters per minute of free air, Knipp's condensation pump, McLeod and DuBrovin gauges. General line of physical and chemical laboratory apparatus.

B. WESTERMAN COMPANY, INC., NEW YORK CITY

Exhibit of the most important publications which appeared in the German and French languages during the year 1935 in physics, mathematics, botany, zoology, chemistry, psychology, technology, geology, biology, social science, economics and general sciences.

JOHN WILEY AND SONS, INC., NEW YORK CITY**Booth No. 61**

The exhibit will include the most recent books in biology, chemistry, engineering, forestry, geography, mathematics, physics and psychology. Particular attention is directed to Doherty and Keller's "Mathematics of Modern Engineering," Lindsay and Margenau's "Foundations of Physics" and Young's "Human and Animal Motivation."

WILLIAMS AND WILKINS COMPANY, BALTIMORE**Booth No. 55**

An exhibit of about twenty scientific journals published by this company, many of them being official vehicles of science societies; also samples of their book output, including works in many fields of science—medicine, biology, physics, chemistry, etc.—including books in medicine for the student and practitioner; also books by four of the leading British medical publishers, which are represented by this company.

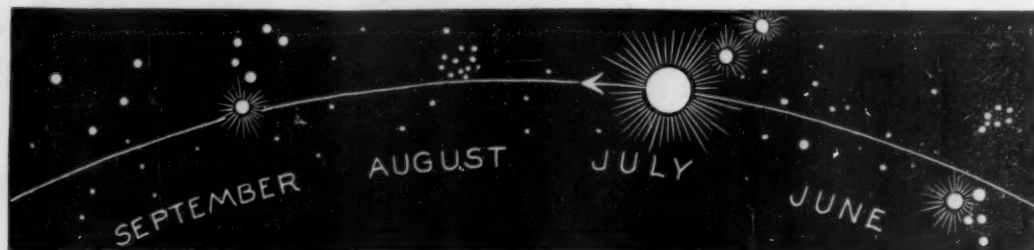
REGISTRATION AND INFORMATION

The privileges to those wearing the association badge at meetings are increasing significantly. The registration is placed in the Exhibition Hall for greatest convenience. Space will be available for the use of members of the press.

7 "NEW PLAN"

TEXTS of The University of Chicago which are meeting a long-felt need in general science courses at universities, colleges and senior high schools throughout the country.

Astronomy



HIGHLIGHTS OF ASTRONOMY, by WALTER BARTKY. Astronomical phenomena explained in the light of everyday experience, with simple charts replacing mathematics, to give a cultural background of the subject for the high school and college student. Illustrated with drawings, charts, photos. \$2.50. *Stellarscope*—an ingenious invention for finding and identifying the stars and constellations—24 sky maps on motion picture film, illuminated and magnified. \$2.00

Mathematics

A MATHEMATICIAN EXPLAINS, by MAYME I. LOGSDON. "An unusually clear and attractive style. . . . For those who wish to acquaint themselves with the fundamental ideas underlying mathematics, this book can be highly recommended. It will be found of special value to students who are finding themselves somewhat lost in the maze of mathematical details presented in the usual courses, and perhaps equally to those who have familiarized themselves with these fields of mathematics and would enjoy learning something regarding their historical background and their current applications."—*Scientific Book Club Review*. Illustrated with line drawings. \$2.00

Geology

DOWN TO EARTH, by CAREY CRONEIS and WILLIAM C. KRUMBEIN. A scientific history of the earth interpreted from the record of the rocks, volcanic outbursts, earthquakes, wind and water. Well suited for introductory courses in geology at first or second-year college levels. Illustrated with drawings, photos, 64 pages of rotogravure inserts. Ready in February. \$3.75

Physics



Delightful drawings by Chichi Lasley add interest and clarity to many of these books.

EXPLORING IN PHYSICS, by REGINALD J. STEPHENSON. Provides many interesting and stimulating problems in physics, including non-numerical problems—a valuable supplement to *From Galileo to Cosmic Rays*. Illus. \$1.50

FROM GALILEO TO COSMIC RAYS, A New Look at Physics, by HARVEY BRACE LEMON. "At last a delightful textbook!" wrote the New York Times in review, "This book deserves a fanfare!" And a fanfare it has received from press, public, and educational world. Within a year it has been adopted by more than seventy universities and colleges. Drawings, stereoscopic photos. \$3.50. Stereoscope—\$0.75

Botany

THE STORY OF THE PLANT KINGDOM, by MERLE C. COULTER. "Dr. Coulter's book is a new departure in teaching texts, as the Chicago course is a new departure in botanical teaching. It is refreshing to get hold of a freshman book with so few pages, yet with so much basic information in plant science, and withal so clearly illustrated."—*Science News Letter*. Illus. \$2.50

Biology

MAN AND THE VERTEBRATES, by ALFRED SHERWOOD ROMER. Written especially for the comprehensive course in biology at The University of Chicago, this book has been widely praised by scientific journals, has been acclaimed for its comprehensive treatment of human evolution, and has received important adoptions. \$3.00

THE UNIVERSITY OF CHICAGO PRESS

PREVIEW OF THE ANNUAL SCIENCE EXHIBITION

In connection with the Annual Meeting of the American Association for the Advancement of Science, Municipal Auditorium, St. Louis, Mo., December 30, 1935, to January 3, 1936

By Dr. F. C. BROWN

DIRECTOR OF EXHIBITS

THE objective presentation of recent scientific progress is intended to increase the color and the interest in the annual meeting.

The special demonstrations enhance the interpretation of recent contributions. The display of instruments and new materials stimulate new routes to discovery. The new publications in science promote new adventures and facilitate broader economic support for science. The applications of science in manufacturing and commerce lend impetus to industrial advance, increase human wants and enlarge the prominence and usefulness of scientists.

The exhibition should stimulate the imagination of workers in related branches of science, and to this end the secretaries are invited to advise and assist the committee on exhibits to obtain maximum representation. Meet your friends at the lounge and be sure to see the 1935 books in the Science Library.

Lecture demonstrations by Ellis L. Manning, of the research laboratory of the General Electric Company, will be given twice daily in Assembly Hall No. 1. W. J. Hodge, of the Johns-Manville Sales Corporation, will give a special lecture demonstration on sound control in Assembly Hall No. 2 on Monday, December 30, at 4:30.

The exhibition is open daily from ten A. M. to six P. M. It closes on January 3 at three P. M. Members of the Association and affiliated societies invited. Adult members of other organizations, societies, clubs, etc., and specially invited individuals admitted by tickets to be obtained from exhibits committee.

COMMITTEE ON EXHIBITS

F. C. Brown, *Director*; Owen Cattell, *Associate Director*; Sam Woodley, *Secretary*; Austin H. Clark; Burton E. Livingston.

LOCAL EXHIBITION COMMITTEE

A. S. Langsdorf, *Chairman*, Jules Bebie, L. G. Blackmer, A. C. Boylston, L. C. Hewitt, W. O. Pennell, Stanley Stokes, F. D. Smith, L. O. Grondahl, *Ex-Officio*.

ACADEMY OF SCIENCE OF SAINT LOUIS

A portrayal of the growth of the Academy since its founding in 1866, together with its accomplishments and aims; especially a model and charts of a proposed Science Museum.

A. S. ALOE COMPANY, ST. LOUIS Booth No. 56

First showing and demonstration of the Scott-Williams Cryostat, a new instrument for the preparation of frozen dehydrated tissue specimens, according to the Altman-Gersh-Bensley method. Tissues are dehydrated and prepared for paraffine inclusion without chemical fixation or alteration. Exhibit and demonstration of microincineration apparatus; the Varney Automatic Colony Counter;

Aloe Precision Water Baths and Ovens; Bryan-Garrey Blood Pipette Rotor; Electrical Petri Dish Inoculator; a wide range of the most modern microscopes, micro projectors; and a general line of recent and new laboratory equipment, including the latest Pyrex glass items. An invitation is extended to visit the showrooms at 1819 Olive Street.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

This exhibit will be divided into three parts, one showing some interesting things about the general work of the association, the second in connection with the Rochester meeting next June, and the third with reference to the next annual meeting in Washington, D. C.

AMERICAN ASSOCIATION FOR DENTAL RESEARCH

Exhibit will comprise charts, photographs and outline graphs illustrating recent developments in dental research. Dr. O. W. Brandhorst is chairman of the local arrangements committee.

AMERICAN DIETETIC ASSOCIATION

A portrayal of the field of work of this association, with specific reference to recent research and emphasis upon the normal diet. Miss Anna E. Boller is chairman of the committee on exhibits.

AMERICAN INSTITUTE OF PHYSICS Henry A. Barton, Director

The members of the association and their guests are invited to visit the exhibit of the eight physics journals published by The American Institute of Physics. Information concerning the Institute and its five Founder Societies will be available.

AMERICAN MEDICAL ASSOCIATION Council on Physical Therapy

By means of graphs, charts, models of apparatus and descriptive literature, the merits and limitations of therapeutic apparatus recommended for treating disease will be considered. Special reference will be given to short-wave apparatus and to ultra-violet equipment. Information will be given, when available, on pseudo-scientific therapeutic appliances. Dr. Thomas G. Hull is director of exhibits.

AMERICAN NATURE STUDY SOCIETY

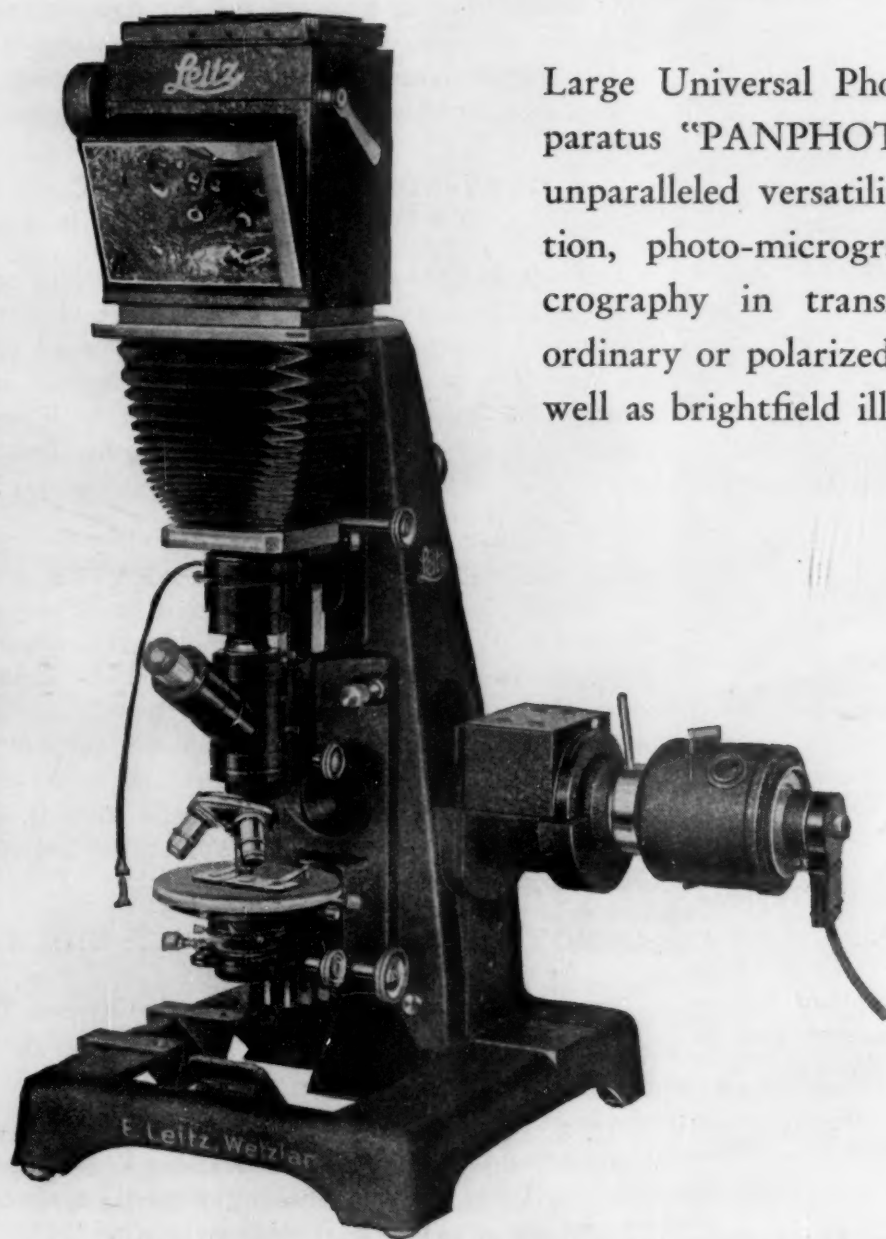
An exhibit of nature materials useful to the amateur nature student and of educational value in schools embodying the work of the society. Charts, nature photographs, collections of various kinds and live specimens where possible will be displayed.

ASTRONOMY

A selection of photographs, transparencies and models representative of the work carried on at some of the

NEW *Leitz* ACHIEVEMENTS

To be displayed at the Annual Science Exhibit at
the Meeting of the American Association for the
Advancement of Science in St. Louis from
December 30th, 1935-January 3rd, 1936, Booth No. 28



Large Universal Photo-Micrographic Apparatus "PANPHOT": An equipment of unparalleled versatility for visual observation, photo-micrography and photo-macrography in transmitted and reflected ordinary or polarized light for darkfield as well as brightfield illumination.

*Other Apparatus to
be exhibited:*

1. Complete equipment for fluorescence microscopy.
2. Ultropak Illuminator for polarized light.
3. New accessories for Ultropak microscopy.
4. Chemical microscope.
5. Micro-Manipulator.
6. Many new devices for scientific photography with the Leica Camera.

E. LEITZ, Inc., Dept. 0
60 E. 10th St. New York City

Branches: Washington, D. C., Chicago, Ill., San Francisco, Calif., Los Angeles, Calif.

leading observatories of the United States will be on display. The work of amateur astronomers will be represented by an exhibit featuring the grinding and polishing of telescope mirrors under the sponsorship of Mr. Simpson, of the Locksley Observatory. Several completed telescopes and numerous photographs of others of all types, sizes and degrees of workmanship will be shown. The uses of completed telescopes made by amateurs will be shown by a series of transparencies of celestial objects of all types, including planets, sun, moon, clusters, nebulae and spectra. Charts illustrating the work of amateurs in the field of variable star and meteor observing will cover these specialized fields. It is expected that a leading attraction will be a working model of the new MacDonald Observatory with its 80-inch reflector recently erected at Mount Locke in Texas. The model will be especially loaned for this exhibit by the Warner and Swasey Company of Cleveland, Ohio, designers of the observatory and its equipment. Harlan T. Stetson, *Chairman*, and Leo Scanlon.

**BAKELITE CORPORATION, BOUND
BROOK, N. J.**

Booth No. 43

This exhibit will feature new developments in plastic materials. These will include Resibond, a new resinoid plywood film; new types of waterproof industrial fabrics which have been treated with special resinoids; water-dilutable resins for producing special types of Bakelite laminated stock; resin-rubber combinations used for the manufacture of brake linings and clutch facings; special resins for printing inks; new synthetic resins for primers, paints, varnishes and enamels; and Luxene resinoid, the new pink translucent denture material. There will also be on display interesting examples of new molded pieces and colorful new cast resinoids.

**BAUSCH AND LOMB OPTICAL COMPANY,
ROCHESTER, N. Y.**

Booth No. 44

An exhibit showing recent developments and improvements in the microscope and its various types of equipment for binocular and monocular vision—with darkfield and polarized-light illumination; other optical instruments for use in special researches and teaching, such as microscopes, microtomes and photomicro cameras.

**P. BLAKISTON'S SON AND COMPANY, INC.,
PHILADELPHIA**

Booth No. 33

These publishers in the sciences cordially invite members of the association and visitors to call and examine their publications, a number of which are new and outstanding in their respective fields. Their new catalogs in chemistry, physics and biology will be available for distribution.

CARNEGIE INSTITUTION OF WASHINGTON

A display in connection with the symposium at Saint Louis on the subject of "Early Man in America."

**CENTRAL SCIENTIFIC COMPANY, CHICAGO
Booths Nos. 51 and 52**

An exhibit featuring a number of new developments and improvements in equipment covering the various branches of science, particularly physics, including apparatus for improved methods in hysteresis measurements and other phenomena; new and improved apparatus for demonstration and laboratory experiments in heat; new instruments and demonstration pieces for illustrating the various phenomena in fields of electricity and light, and new instruments associated with and used in connection with modern physical research.

**CHICAGO APPARATUS COMPANY, CHICAGO
Booths Nos. 80 and 81**

An exhibit showing standard and new developments in apparatus for research and teaching, especially in the fields of physics, chemistry and biology, also osteological preparations, biological models and animal and plant collections.

**CLAY-ADAMS COMPANY, INC.,
NEW YORK CITY**

Booth No. 32

This company has augmented its varied teaching equipment by adding new models in their series of Durable Anatomical Models. These are made of pressed paper, are free from plaster with emphasis on detailed structures. Their exhibits will include also Life Histories, Genetic preparations, Osteological specimens, Botanical and Zoological items and the Promar Microscopic Projection and Drawing Apparatus.

COMPTON EFFECT APPARATUS

The Compton effect was discovered at Washington University in 1922-23. Much of the original apparatus remains intact and is shown in this exhibit. Enlarged copies of the curves describing the results of the original experiment and taken from Compton's original paper are shown. A short description of the photon theory of the Compton effect is given upon a chart. Professor G. E. M. Jauncey, Department of Physics, Washington University, is in charge of the exhibit.

DENOYER-GEPPERT COMPANY, CHICAGO

Booth No. 103

New materials shown will include the Korsmo Weed Charts, the Donitz-Hartmann Parasitic Protozoa Charts, and a new series of Parasitology charts.

U. S. DEPARTMENT OF AGRICULTURE

Exhibit showing results of the research and demonstration program of the Soil Conservation Service in the Great Plains area of severe wind erosion.

**EASTMAN KODAK COMPANY,
ROCHESTER, N. Y.**

Booth No. 45

A number of new photographic items are on exhibit. Eastman Pola-screens, which are large polarizing filters, will be demonstrated, together with photographs made with them. The processing of 16 mm. Kodachrome Film will be illustrated by a series of transparencies. The Cine-Kodak Special will be shown in connection with a

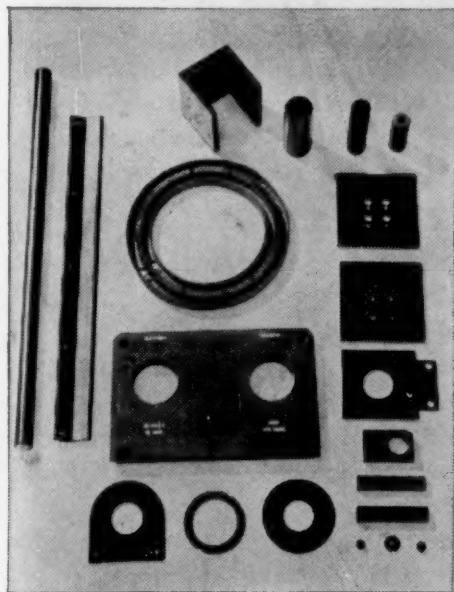
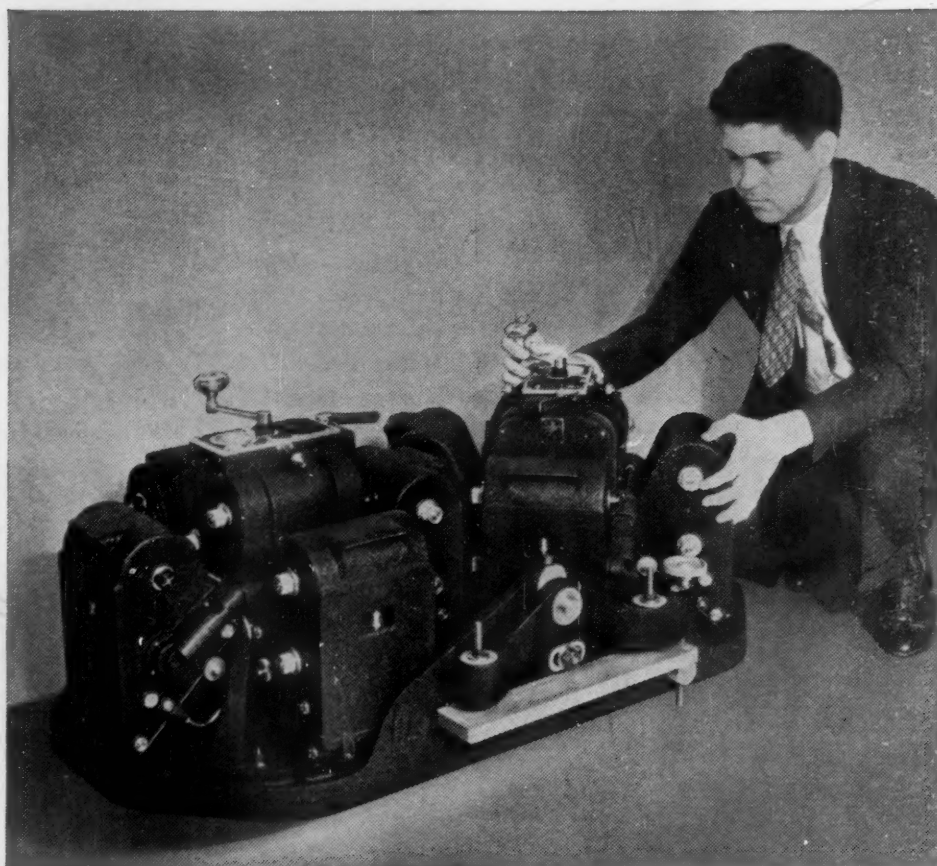


The World's Largest Camera

relies on Bakelite Materials

A 275-POUND, ten-lens compound aerial camera has recently been developed by the Fairchild Aerial Camera Company of Woodside, Long Island. Capable of photographing 760 square miles of territory at a single exposure, it represents a major contribution to topographic science as the first practical means of charting vast unmaped sections of the earth's surface.

In the assembly of this intricate precision instrument, parts formed from Bakelite Materials are relied upon to perform numerous func-



Some of the Bakelite Molded and Laminated parts used in the Fairchild Camera.

tions of high responsibility. Because of their unusual combination of strength, durability, electrical insulation, ease and accuracy of forming, and high resistance to oil and moisture, Bakelite Molded and Bakelite Laminated were selected for the making of shutter bus bar housings; lamp socket plates; operating switch insulators; transformer, condenser and relay terminal panels; and other vital parts.

Today a steadily increasing vari-

ety of scientific instruments and other products are employing Bakelite Materials to meet similar needs for greater versatility and dependability. Manufacturers of instruments and other precision products can benefit from a thorough understanding of the properties and characteristics of these improved modern materials. Write for our informative booklets 40M, "Bakelite Molded" and 40L, "Bakelite Laminated".

BAKELITE CORPORATION, 247 Park Avenue, New York, N.Y. 43 East Ohio Street, Chicago, Ill.
BAKELITE CORPORATION OF CANADA, LIMITED, 163 Dufferin Street, Toronto, Ontario, Canada

1910—SILVER ANNIVERSARY—1935

BAKELITE

The registered trade marks shown above distinguish materials manufactured by Bakelite Corporation. Under the capital "B" is the numerical sign for infinity, or unlimited quantity. It symbolizes the infinite number of present and future uses of Bakelite Corporation's products.

THE MATERIAL OF A THOUSAND USES

new electric timing device which has special application to scientific photography. Several new applications of Grenz ray technique in the field of textiles will be shown. Spectrograms will be displayed of the several new spectroscopic plates. Several newly introduced organic chemicals will be displayed. The display will also include the Microdak, Eastman Clinical Camera and several Kodak miniature cameras.

**ENCYCLOPAEDIA BRITANNICA,
NEW YORK CITY**

Booth No. 104

A display of the latest edition of the Encyclopedia Britannica of interest to scientists in all departments of work.

**ERPI PICTURE CONSULTANTS
A Subsidiary of ELECTRICAL RESEARCH
PRODUCTS, INC., NEW YORK CITY**

Booth "Special"

Sound motion pictures for science teaching, including new sound pictures for teaching geology; A music system for reproducing sound from vertically recorded disc records; Western Electric Timing System, consisting of a high-speed motion picture camera combined with precision timing; Watch Rate Recorder for quickly determining the rate of clocks and watches to a high degree of precision; Rotating Mirror Oscilloscope for picturing sound vibrations.

**ETHYL GASOLINE CORPORATION,
NEW YORK CITY**

Booth No. 36

This will be an exhibit showing certain technical advancement made by this corporation under the direction of Thomas Midgley, Jr., vice-president.

**FEDERAL BUREAU OF INVESTIGATION
U. S. Department of Justice**

Exhibit depicting activities of the Bureau in connection with its law enforcement work, particular emphasis being placed upon scientific aids utilized in the Bureau's laboratory; model laboratory, firearms identification, moulage, typewriting and document identification, methods of detecting invisible writings, microscopy, use of x-rays for examination of suspected packages, benzidine test to determine presence of blood, exhibit of equipment and instruments used by the Bureau in laboratory activities. Fingerprint identification: Model single and ten fingerprint files will be on display; fingerprinting table for purpose of taking impressions of delegates and classifying and filing the same, if desired; demonstration of use of mechanical equipment in searching of fingerprints; development of latent fingerprints and illustrations as to use in nationally known cases; international exchange of fingerprints, with reproductions of records from various foreign countries. Training, investigative and crime statistics: Curriculum of Training School; charts and maps depicting and illustrating important cases investigated by Bureau, with exhibits taken by agents in such cases; investigative jurisdiction and statistical accomplishments; crime statistics compilation. Pamphlets concerning the Bureau's work will be available for delegates.

A movietone will be shown at periodic intervals depicting activities in Bureau headquarters at Washington, D. C.

**FORD MOTOR COMPANY, JOHANSSON
DIVISION, DEARBORN, MICH.**

Booth No. 63

An exhibit showing some early measuring instruments dating from 1740 loaned by the Edison Institute, Dearborn, Mich., together with several of C. E. Johansson's first instruments used in measuring Johansson Gauge Blocks. An exhibit of these accurate gaging tools now in use and demonstrations of how they are used.

U. S. FOREST SERVICE

A collection of wood specimens of Missouri native trees, showing cross and tangential cuts, supplemented by a pictorial display of the work of this Service as affecting trees, shrubs, forage, plants, fish and game of these areas, under the supervision of specially trained scientists (Junior Foresters). The exhibit is in charge of Paul D. Kelleter, Forest Supervisor.

R. FUESS, INC., NEW YORK CITY

Booth No. 82

The Fuess Universal Optical Bench and accessories, with a special demonstration of photoelasticity with a new polarizer; also other Fuess instruments for Spectroscopy, Microscopy and Micro-Photography.

**GENERAL BIOLOGICAL SUPPLY HOUSE,
CHICAGO**

Booth No. 31

An exhibit of Biological materials and equipment exclusively. Included in this exhibit will be demonstration materials, apparatus, microscope slides and other teaching aids for the biology laboratory. Special attention will be given to materials illustrating up-to-date methods used in the preparation of modern materials and equipment for biology.

**GENERAL ELECTRIC COMPANY,
SCHENECTADY, N. Y.**

Booths Nos. 85 and 86 and Assembly Hall

Lecture-Demonstrations by Ellis L. Manning, Research Laboratory: The past forty years have witnessed a considerable extension of knowledge in the direction of the infinitely small. Electron devices have become important and dependable tools in research laboratories; they are responsible for much of the notable advance in communication methods; they are beginning to enter the industrial and engineering fields; they show promise in the fields of medicine and biophysics. Demonstration-talks will be given twice daily during the five days of the meeting, describing and illustrating the behavior of many recent electronic devices. The discussion will be couched in language that is readily understood by those who are not technically trained in physics and engineering. The demonstrations will be sufficiently unusual to attract all who are interested in science. There will also be a demonstration of recording photoelectric spectrophotometer by J. L. Michaelson, General Engineering Laboratory. There is a growing demand in industry and research for the precise measurement of color. It is generally recognized

1935-36 Meetings American Association for the Advancement of Science

You are cordially invited to inspect the Turtox exhibit which will be on display in booth No. 31, just a few steps from the registration desk.

A few of the items to be shown are:

1. New polarized light outfit to fit any standard compound microscope.
2. Turtox Classroom Charts.
3. Several new microscope slides for cytology.
4. A new system of display cases for dry biological specimens.



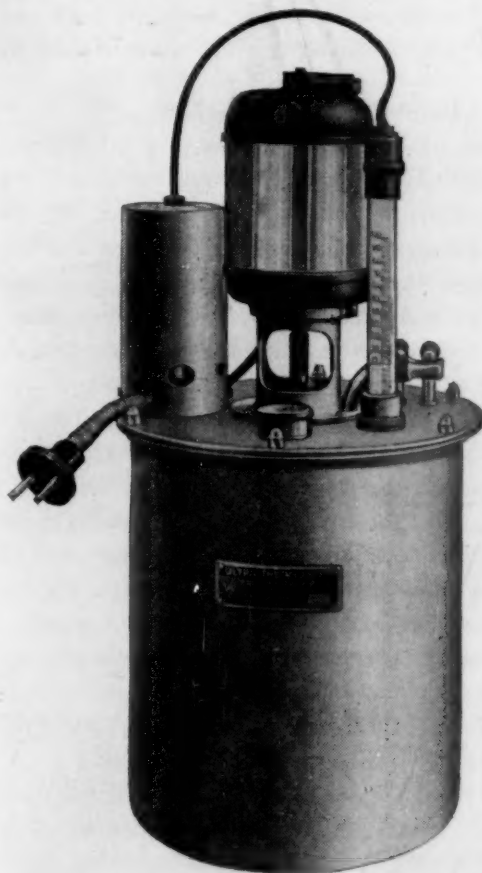
*The Sign of the Turtox
Pledges Absolute
Satisfaction*

Check the items which interest you and see them at our exhibit or write for information about them.

GENERAL BIOLOGICAL SUPPLY HOUSE

Incorporated

761-763 EAST SIXTY-NINTH PLACE
CHICAGO



HÖPPLER ULTRA THERMOSTAT

completely automatic, delivers to the instrument for continuous service 5 liters per minute of constantly tempered liquid.

Temperature Constant $\pm 0.005^{\circ} \text{C}$

Temperature Limits $-35^{\circ} + 300^{\circ} \text{C}$

for:

Refractometry

Viscosimetry

Serology

Made by the makers of the Höppler Viscosimeter

U. S. Agents

FISH-SCHURMAN CORPORATION

230 East 45th Street

New York City

that spectrophotometry provides the only fundamental method of color specification. There will be a demonstration of a new recording photoelectric spectrophotometer invented by Professor A. C. Hardy, of Massachusetts Institute of Technology, and developed for application to industrial problems and research by the General Electric Company.

GRADWOHL SCHOOL OF LABORATORY TECHNIQUE, ST. LOUIS

Booth No. 60

This exhibit will detail methods of instruction in laboratory technique, with recent developments. Attention will be called to the rapid method of Krajian for staining spirochaetes in tissue, also to Krajian's method for demonstrating urea crystals in brain in uremic cases. Facts on blood development according to Schilling's ideas will be shown, as well as numerous microscopical specimens illustrative of the type of work performed in the institution. Dr. Gradwohl's new book, "Clinical Laboratory Methods and Diagnosis," will be on exhibition. This is a complete, up-to-date manual of laboratory methods.

J. B. HAYES, INC., URBANA, ILL.

Booth No. 68

This firm, which manufactures x-ray diffraction equipment and other precision scientific appliances, will exhibit an x-ray laboratory, including an x-ray diffraction unit and a number of cassettes and cameras designed to facilitate the application of x-ray diffraction to a wide variety of industrial and theoretical problems; also examples of recent industrial applications of x-ray diffraction.

ILLINOIS STATE GEOLOGICAL SURVEY

Exhibit of (1) the mineral resources of the State of Illinois; (2) resinous products therefrom; (3) objective presentation of researches in geology, physics and chemistry, these presentations to be accentuated by dioramas, choice specimens, balopticon story and unique explanations.

JESUIT SEISMOLOGICAL ASSOCIATION

A joint exhibit by the following institutions: Canisius College, Buffalo, N. Y.; Loyola University, Chicago, Ill.; Xavier University, Cincinnati, O.; John Carroll University, Cleveland, O.; Regis College, Denver, Colo.; Fordham University, New York, N. Y.; Georgetown University, Washington, D. C.; St. John's Seminary, Little Rock, Ark.; Marquette University, Milwaukee, Wis.; Mt. St. Michael's College of Gonzaga University, Spokane, Wash.; Loyola University, New Orleans, La.; University of Santa Clara, Santa Clara, Calif.; St. Louis University, St. Louis, Mo.; Spring Hill College, Mobile, Ala.; Weston College, Weston, Mass. The exhibit will include photographs, seismograms and other seismological displays exhibited by the participating institutions, maps showing their relation to the other seismographic stations of the world, recent research publications, for example, the Brunner Focal-Depth-Time-Distance Chart for the study of deep earthquakes, models and demonstrations illustrating seismological methods and recent results in the study of

earthquakes and of the structure of the earth's crust, and of its deep interior. James B. Macelwane, S.J., St. Louis University, *chairman*.

JOHNS-MANVILLE SALES CORPORATION, NEW YORK CITY

Booth No. 101

Exhibit will be devoted to this company's activity in the field of sound control. In our modern world noise and sound control have become major problems demanding extensive research and engineering activity. Johns-Manville has been engaged in this work for twenty-four years, but greater advancement has been made in the past six years than ever before. In addition, they will give a courtesy demonstration lecture and motion picture on the stage of the Assembly Hall. This lecture will not only appeal to every person who has an interest in science but will have a particular attraction for those who are interested specifically in recent advances in all the phases of noise quieting and the scientific control of sound.

JUNIOR SCIENCE CLUBS

The work that is being done by the Junior Science Clubs is of much concern to the future development of the Association, and members will be much pleased to learn what is being done.

THE KELLOGG COMPANY, BATTLE CREEK, MICH.

Booths Nos. 78 and 79

A display consisting of the Kellogg's ready-to-eat cereals and Kellogg's Kaffee Hag coffee. The exhibit will emphasize results of research which has been carried on with these products during the last three or four years.

CHARLES T. KNIPP

Department of Physics, University of Illinois

A Cold Cathode Rectifier. This rectifier makes use of Hittorf's principle of limiting the expansion of Crookes dark space. Voltages up to 50,000 have been rectified by it. The phenomenon will be made visible: (a) by observing the discharge in a vacuum tube, (b) by simultaneously observing the trace of the wave-form on a cathode-ray oscillograph. Cathode Rays Leave the Surface Normally. A novel and unexpected way of showing a well known phenomenon. An Electronic Transient Visualizer. Transient oscillations in electrical circuits are made visible as stationary patterns on a cathode-ray oscillograph by initiating the transients at the beginning of each linear sweep of the cathode-ray beam. The effect of variation of circuit parameters may thus readily be demonstrated. The image is sufficiently stationary to be photographed.

VERN O. KNUDSEN, UNIVERSITY OF CALIFORNIA, LOS ANGELES

Audible sound, above frequencies of about 5,000 cycles, is highly absorbed by CO₂. In the demonstration, a 9,000-cycle tone is reduced to 1/10,000 of its initial intensity after traveling through a ten-foot length of water pipe filled with CO₂. The absorption increases at higher frequencies, but there is relatively little absorption for frequencies below 5,000 cycles.

SCIENCE NEWS

Science Service, Washington, D. C.

THE CARNEGIE INSTITUTION EXHIBITION

NEW developments in scientific fields were shown to the Board of Trustees of the Carnegie Institution of Washington at its meeting on December 13 in review of the year's work of some 400 staff members and research associates in laboratories and observatories scattered at strategic points throughout the world. A three-day exhibition was also open to the public at the Washington headquarters.

Mathematical estimates of the racing capacities of thoroughbred colts yet unborn have been worked out by Dr. Harry H. Laughlin, of the Eugenics Record Office at Cold Spring Harbor, N. Y. Dr. Laughlin's formulae take into account past performances of all notable racehorses in any given animal's pedigree, and although they can not be used for setting the odds in any particular race, they will give the owner an idea of what he can expect of his foal in the long run. Dr. Laughlin has worked out an ideal "synthetic" horse, which has not yet been realized in the flesh, although it might be possible to approach him, given proper breeding opportunities.

Samples of sea-bottom rocks can be obtained by a kind of short cannon that is lowered on a cable, to fire a hollow projectile against the floor with a charge of powder. The hollow shell punches out a piece of the bottom just as a watermelon "plugger" takes a sample of the melon. The sample of rock can then be hauled to the surface for study and preservation. In the development of this apparatus, the Geophysical Laboratory of the Carnegie Institution and the Geological Society of America worked in cooperation, with assistance also from the Du Pont Powder Company and the U. S. Lighthouse Service.

From the laboratories of embryology in Baltimore came a stage in the development of the monkey that has never been seen before. It is the living organism at the point where it is simply a hollow ball of cells filled with fluid, resulting from the original fertilized egg. At the stage shown, it is just ready to become attached to the maternal tissues, to begin its slow development leading to birth.

Folsom Man, whom archeologists recognize as the earliest known American, but whom they have perforce left vaguely "in the air" as to date, is at last restored to a time in American prehistory. Edgar B. Howard, who has made studies at Clovis, New Mexico, exhibited evidence that Folsom Man was present in America about 10,000 B. C. This is the age assigned on geological evidence to a lake bed at Clovis where some of Folsom Man's distinctive grooved stone spear-points were lost. Mr. Howard also reports that America's oldest hunters, these Folsom Men, used unique stone weapons. Their grooved darts, thin and leaf-shaped, are not matched by any Stone Age weapons found elsewhere in the world.

Electrical tides in the earth—great surges of electric current intimately tied up with the Northern Lights and magnetic disturbances—were demonstrated in a working

exhibit by the department of Terrestrial Magnetism. The earth currents affect compass needles and telegraph communication; the latter, in fact, was the means of discovering the currents in 1844.

Experimental studies in the Geophysical Laboratory on the actions of solutions under pressures as high as 180,000 pounds to the square inch, are disclosing new facts on such different things as the air man breathes, the human blood, beverages of all kinds, oil, gasoline, glass and the lavas flowing from volcanoes. All these are solutions having common broad problems.

OBSOLETE NAVY MAGNET FOR RESEARCH
AT COLUMBIA UNIVERSITY*(Copyright, 1935, by Science Service)*

THE giant, and now-obsolete electromagnet of the Navy's radio station at Annapolis is to be shipped to Columbia University where scientists will turn it into one of the most powerful tools in the world for smashing atoms and learning new facts about atomic nuclei.

Built for wartime use, the 130,000-pound electrical giant now lies dismantled in a field. On December 14 a fleet of trucks was expected to take the sections to Columbia's physics department where a special submerged concrete bed—jokingly called the wading pool from its appearance—already awaits its coming.

So large are the various sections of the equipment that a special sloping trench has been dug down which the apparatus can be skidded into its basement laboratory. When assembled it will stand ten feet high.

Across the large pole pieces—forty inches in diameter—it will be possible to create intense magnetic fields tens of thousands of times stronger than those of the earth which keep compasses pointing to the north. In technical terms the magnet will have a magnetic field strength of from 10,000 to 12,000 gauss.

For science the renaissance of the Navy's electromagnet will bring into use another apparatus for possible experiments on atomic transmutation, artificial radioactivity and studies on the happenings within the cores, or nuclei, of atoms when they are bombarded with other atomic particles accelerated to high energy in the device.

Pioneer equipment in the field is the apparatus of Professor E. O. Lawrence, of the University of California, which still holds the record for size, weighing 85 tons and having pole pieces with an effective diameter of 45 inches.

The California apparatus has as its essential part another wartime electromagnet built for, but never shipped to, one of the now-defunct Chinese governments. At the time of the war such huge electromagnets were planned and built for Poulsen quenched arc wireless telegraph transmitters, the latest development at that time.

The advent of vacuum radio tubes has now rendered this type of equipment generally obsolete for radio communication, though the arc transmitter built for Columbia's new magnet was so good that it was in full use at

the Annapolis 500,000 watt high-power station until 1934. Its use was mainly for general broadcast messages to Navy ships and stations throughout the world and some point to point communication. A new vacuum tube transmitter of the same 500,000 watt power is now being installed to take its place.

The imminent shipment to New York of the 65-ton electromagnet from the Navy's radio station at Annapolis was confirmed by Dr. George B. Pegram, professor of physics at Columbia University, who said: "The large atomic particle accelerator which we plan to build from the Navy equipment operates on the scientific principles used in the cyclotron apparatus as designed and employed by Professor E. O. Lawrence at the University of California.

"Essentially, charged particles, either protons, the nuclei of hydrogen atoms, or deuterons, nuclei of the isotopic heavy form of hydrogen known as deuterium, are introduced into the cyclotron apparatus.

"Once inside the accelerating chamber, which looks like a large covered frying pan, they are bent by the strong magnetic field existing across the pole pieces of the large electromagnet. Under the action of the magnetic field they travel round and round in a circular, or strictly, a spiral path.

"Twice each trip around the circuit the charged particles are speeded up by several thousand volts potential provided and properly timed by auxiliary electrical equipment. These individual increases of velocity—often called electrical 'kicks'—ultimately raise the total energy of the whirling particles to very large values.

"In a few seconds and a few hundred trips around the circuit of Professor Lawrence's apparatus, for example, the velocity and kinetic energy of the charged particles can be increased to several millions of electron volts."

HIGH PRESSURES USED BY CHEMICAL INDUSTRY

How man has succeeded in producing synthetic nitrogen compounds and synthetic alcohols at low cost and in sufficient quantity to supply the world's needs was described at a meeting of the Franklin Institute, Philadelphia, by F. A. Wardenburg, general manager of the Ammonia Department, du Pont Company, Wilmington, Del.

High-pressure synthesis is the technique by which these results have been accomplished. Mr. Wardenburg said that pressures as high as 15,000 pounds a square inch are employed, such a pressure being equivalent to a column of water thirty times as high as the Empire State Building. At this pressure the gaseous raw materials used in the process have a density about one-third that of water, whereas ordinarily the same gases are much lighter than air.

Most of the high-pressure synthesis plants here and abroad are designed to "fix" atmospheric nitrogen in the form of ammonia, which in turn can be converted to nitric acid and nitrates, materials essential to peace-time industry and agriculture as well as to national defense. During the peak year of the World War, Mr. Wardenburg pointed out, when practically all of the explosives

required by the allies were made in America, no less than fifty ships were required to transport nitrate of soda from Chile to Atlantic ports. In the event of another similar emergency, the country would be entirely independent of Chile.

Of further significance is the fact that through the new high-pressure synthesis technique, cheaper nitrogen fertilizers have been made available throughout the world. Also, by a similar technique, gases can be combined to produce alcohols and other chemicals at a cost far below that achieved previously.

QUARANTINE FOR MENINGITIS

HEALTH authorities in Washington are surprised at reports that thirty thousand inhabitants of Kiowa County, Okla., are under quarantine to prevent the spread of meningitis. Quarantine of this sort is considered impractical, if not absurd. The only measures recommended for checking the spread of the disease are isolation of the patient and disinfection of his bedding, clothes, and any mouth and nose discharge, and avoidance of crowds.

The reported regulation preventing persons from leaving the county without showing a negative test for the disease is held particularly impractical. The only way to determine the presence or absence of the meningitis "germ" is by examination of the fluid from the spinal cord, which is obtained by spinal puncture, a painful and difficult surgical procedure. During the World War attempts were made to check the spread of meningitis by quarantining all healthy carriers of the disease, but this was found to be not only impractical but impossible.

For the week ending December 7, latest on which figures are available, no cases of the disease were reported by the Oklahoma State Health Officer to the U. S. Public Health Service. The federal health service has wired the state health officer for information on the present outbreak, which is said to have started in a CCC camp at Purcell.

Early in the year outbreaks of meningitis in transient camps and shelters caused some alarm in the neighborhood of these camps. Public Health officials declared at that time that the disease was not likely to spread from such camps to the rest of the population. Crowded living conditions, such as may exist in tenements, in barracks and in the steerage of ships, are particularly favorable to the development of epidemics of meningitis.

Meningitis is an inflammation of the membranes covering the brain and spinal cord and in epidemic meningitis this inflammation is caused by a "germ" called the meningococcus. The disease usually starts suddenly with severe headache and fever. A serum has been developed which has been partially successful in treating the disease.

MOVIES OF PLANTS

PLANTS moving with rhythmic grace as though in an esthetic dance, plants getting "drunk" on a whiff of poisonous carbon monoxide, featured a botanical movie show put on at a meeting of the New York Academy of Sciences on December 15, by Dr. William Crocker, of the

Boyce Thompson Institute for Plant Research, Yonkers, N. Y.

In the "Dance of Life" pictures, the plants, being rooted, perforce emulated some of the modernist human dancers, who "move everything but the feet." They swayed and undulated from side to side, slowly raised their leaves in unison, like arms, and slowly lowered them again. Tips of twining plants circled like the heads of snakes. Roots "wormed" through the earth.

It was all done by the opposite of the process used in making slow-motion movies. In taking slow-motion pictures, the camera is run at greatly increased speed while taking, and the finished films projected at ordinary speed, thereby greatly slowing down the apparent rate of motion. In the films shown by Dr. Crocker, the "time-lapse" process was used. In this, the camera is set up in front of the plant and the motor-operated shutter is set for exposures at intervals of several minutes, hours or even days. In this way the plant's motions, imperceptible to the eye, are "condensed," and become evident when the film is projected at normal speed. The hundred days of a corn plant's life can be packed into five minutes of projection.

The graceful, sinuous "dance" of a growing plant is due to the fact that not all its cells expand at the same rate. Consequently, one side of the stem or leaf, or other organ is always growing a little faster than the other, and pushes the tip in the opposite direction. Then the other side grows faster for a while, and the plant sways the other way.

Plants were shown getting "soused" on two different gases, ethylene and carbon monoxide. The first gas, which has been much used for producing ripe color on fruits, stimulating seeds and cuttings to grow, etc., affects plants in very low concentrations. When used as a mixture of one part in a half-million of air, its first effect was stimulating. The growing tissues on the upper sides of tomato and sunflower leaf-stems grew faster, causing the leaves to turn downward. The youngest leaves were most sensitive, but soon the mature leaves "noticed" it also. Restored to clean air, the plants recovered and the leaves returned to position, though the older ones could not quite get back to normal.

Mimosas, or sensitive plants which can fold down their leaves when touched or otherwise stimulated, got so drunk on carbon monoxide that they would not react, even to heat. They were like intoxicated persons who can be burned without noticing it. Yet their recovery by the morning after was complete, with no noticeable hang-over.

ITEMS

THE trumpeter swan, among the rarest of American wildlife species, was down to about ten pairs, because of illegal shooting and lack of protection, when the Interior Department called attention to its perilous state, Secretary Ickes states in his annual report. Thereupon the Biological Survey set aside their one known nesting area as a migratory wildfowl refuge. It is estimated that a total of more than eighty birds will come through the present winter.

TOBACCO plants as tall as trees are among the strange vegetation of the lower Andean country now being in-

vestigated by an expedition from the University of California, under Professor T. H. Goodspeed. One of the tremendous tobacco growths measured by Professor Goodspeed was sixty feet high. The expedition is engaged primarily in a search for wild relatives of the common cultivated tobaccos, to be used in hybridization experiments. Seeds of many other kinds of plants, however, are being collected.

NEANDERTHALERS lived in Italy as well as elsewhere in Europe during the early days of the Old Stone Age. This is confirmed by the discovery of a second Neanderthal skull at Saccopastore, in the Tiber Valley. A Neanderthal skull was found in Italy several years ago, but since it was the only one known it might have been a "stray." The discovery of this second skull, in the same geological formation and accompanied by the bones of animals used for food, is regarded as strong evidence that Italy once had its population of Neanderthals. Dr. Blanc, of the Geological Institute of Pisa, and the Abbé Henri Bréuil, of the Paleontological Institute of Paris, reported the find.

THE annual report of the Secretary of the Interior states that Boulder Dam, completed during 1935, has already prevented one menacing flood in the Imperial Valley of California. Shortly after the gates of the dam were closed a flood level flow of 105,000 cubic feet per second of water raged in the Colorado above the dam. Had this water passed on, the Imperial Valley would have been menaced. Instead, the waters began filling up the 115-mile-long lake and reservoir above the dam which has already been set aside as a bird refuge and stocked with game fish. Boulder Dam will make impossible a repetition of the 1934 disastrous drought in the Imperial Valley which cost the region over \$10,000,000, adds the report.

CENTRALIZATION is the order of the day in the activities of the Academy of Sciences of the USSR. The academy's principal activities, formerly divided between the one-time capital at Leningrad and the present capital at Moscow, have been concentrated at Moscow; and in addition, in several instances bureaus once separate have been consolidated. Outstanding is the establishment of an Institute for Physical Studies, under the directorship of Dr. P. L. Kapitza, for whom the research apparatus he used at the University of Cambridge has been purchased. Other research bodies established by the reorganization of the academy include Institutes of General and Inorganic Chemistry, of Animal and Human Physiology, and of Evolutionary Morphology and Paleozoology, a Laboratory of Mechanics and several museums.

GREAT transport planes, carrying tons of passenger and freight loads, have reason to be afraid of pocket gophers, small animals less than the size of rats or squirrels. The gophers love the open grass stretches of landing fields, and burrow shallow runways close to the surface, making landings rough and bumpy, and sometimes tripping up a plane into a "nose-over." The U. S. Biological Survey, which has had long experience in ridding ranches and farms of small rodent pests, has lately been cooperating with the Bureau of Air Commerce in ridding landing-fields of the troublesome pocket gophers.



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"It has been the aim of the authors of this book to write a text suitable for one semester's course in which the principles of both physical and historical geology must be presented. Their declared purpose has been to emphasize principles and geologic reasoning rather than to deluge the beginner with facts and technicalities; to provide an enjoyable review of the field without burdening the student with detail and terminology forgotten immediately after the examination; to present the essential facts and principles clearly and simply, bearing in mind that very few members of any beginning course ever become professional geologists.

"A perusal of the book discloses that they have accomplished their purposes to a high degree. The long teaching experience of both of the authors is readily apparent in the thorough organization and simple and clear presentation of the subject matter, and in the complete manner in which the text is illustrated. A chapter on the organization of matter leads to the subject of volcanism and igneous rocks, and this is followed by a discussion of the weathering of igneous rocks. Attention now logically turns to the physical agents and succeeding chapters treat of the work of running water, ground water and the ocean. Sedimentary rocks and then metamorphic rocks are treated at this point, after which the discussion turns back to snow and ice and their geologic work, and

the work of the wind. Chapters on structures and diastrophism, and earthquakes complete the part devoted to physical geology. It comprises 300 of the 450 pages of the book.

"In the beginning chapters of Part II, Historical Geology, care is taken to explain the principles by which earth history is deduced, before the facts concerning the Pre-Cambrian and Cambrian are presented. The Paleozoic is treated in three chapters as Lower, Middle and Upper; three chapters are devoted to the Mesozoic, and one each to the Cenozoic and the Pleistocene. A special chapter on petroleum geology is inserted after the one on the Lower Paleozoic. The paleogeographic maps are clear, well drawn and make a pleasing appearance.

"The book is profusely illustrated, there being few facing pages without at least one picture or diagram. For the most part the pictures are well selected to illustrate the text and the majority are excellent photographs well reproduced. But to those geologists who are averse to the use of retouched photographs, it will be a source of regret that it was necessary to use so many negatives that had to be retouched.

"Teachers of introductory courses in geology should find this a very usable text."

J. S. WILLIAMS

in the *American Journal of Science*

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SCIENCE NEWS

Science Service, Washington, D. C.

SCIENCE REVIEW OF THE YEAR

Physics

A NEW value for the atomic weight of hydrogen at 1.0081 instead of 1.0078 was determined by Professor M. L. E. Oliphant, A. E. Kempton and Lord Rutherford, at the Cavendish Laboratory, University of Cambridge, on the basis of atomic bombardment experiments.

By squeezing materials with pressures as high as a million pounds to the square inch while twisting them, Professor P. W. Bridgman, of Harvard University, is duplicating in the laboratory some conditions found within the earth which may account for the synthesis of strange compounds at ordinary temperatures.

The National Advisory Council on Applied Physics was formed to promote the wider use of physics in industry.

Preliminary stages of a new theory of physics which will link relativity with the quantum theory in explaining atom happenings were devised by Professor Albert Einstein and Dr. N. Rosen, of the Institute for Advanced Study at Princeton, N. J.

Controversy continued over the new theory of relativity announced by Sir Shah Sulaiman, Indian justice and mathematician, which seeks to link the concepts of Newton and Einstein; criticism was advanced by D. R. Hamilton, Princeton mathematician, and the critique in turn was challenged by Sir Shah.

General agreement among scientists that a considerable amount of the incoming cosmic radiation is of an electrified particle nature was announced during 1935, but whether the initial rays are chiefly photons or particles is still a topic of debate.

A new yardstick for measuring the earth's velocity, relative to the rest of the universe, may be the variation in cosmic ray intensity, according to a theory advanced by Professor Arthur H. Compton, University of Chicago.

The magnetic field of the earth is lopsided, Dr. R. A. Millikan and H. Victor Neher, California Institute of Technology, determined from a precision sea-level survey of cosmic ray intensities made on ten different ships sent on voyages all over the world. Professor M. S. Vallarta, Massachusetts Institute of Technology, gave a theoretical interpretation of this phenomenon.

High altitude experiments on Mexican mountain tops gave Dr. Thomas H. Johnson, Bartol Research Foundation, further verification for the concept that the earth has a magnetic shadow.

Important observations of cosmic rays were made at the top of Pike's Peak by Drs. C. D. Anderson, R. A. Millikan and S. H. Neddermeyer.

A new explanation of the origin of cosmic rays which considers the rays as free particles in space which have been increasingly accelerated on their unimpeded journey to measurement on the earth was announced by Professor E. A. Milne, Oxford University, England.

By a technique comparable with determining a hurricane's force by the amount a ship might be blown off its course, Professor W. F. G. Swann and Dr. W. E. Dan-

forth, Bartol Research Foundation, are using cosmic rays to study the strength of magnetism within a magnet.

By bombarding the light element lithium with protons, Professor C. C. Lauritsen and coworkers, California Institute of Technology, produced 16,000,000 electron volt gamma rays, six times as piercing as the strongest of those produced by natural terrestrial sources.

Synthetic radiosodium, hailed as a possible substitute for radium in the treatment of cancer by radiation therapy, was made in increased amounts by Professor E. O. Lawrence, University of California.

A giant x-ray tube for use with the great 7,000,000 volt electrostatic generator is being developed by Professor Robert Van de Graaff, of the Massachusetts Institute of Technology.

Using a vacuum rotor, Dr. J. W. Beams, University of Virginia, created forces 7,000,000 times as great as gravity for use in separating isotopes.

Evidence that the base of the stratosphere varies from 4.7 miles to 7.5 miles above the earth within a day was obtained by sounding balloon investigations carried on by investigators of the Massachusetts Institute of Technology at St. Louis, Mo.

Samples of the air 13 miles above the earth were obtained by the stratosphere balloon *Explorer II* and in England with smaller sounding balloons.

Three-dimensional x-ray pictures were produced by Dr. O. Russo, State Roentgen Institute, Moscow.

Further research on rockets at Clark University indicated a way to permit rocket flight in the stratosphere without the necessity of carrying liquid to burn the rocket fuel.

A new record for the "coldest cold" was set at only five one-thousandths of a degree above absolute zero by Professor W. J. De Haas, University of Leyden.

That temperatures of 1,700 degrees Fahrenheit 150 miles above the earth are needed to explain the results of radio reflection experiments from the ionized layers there, was found by Professor E. V. Appleton, University of London.

Another radio reflecting layer high above the earth at an altitude of 35 miles, called the D layer, was discovered by the Indian scientist, Mitra P. Syam.

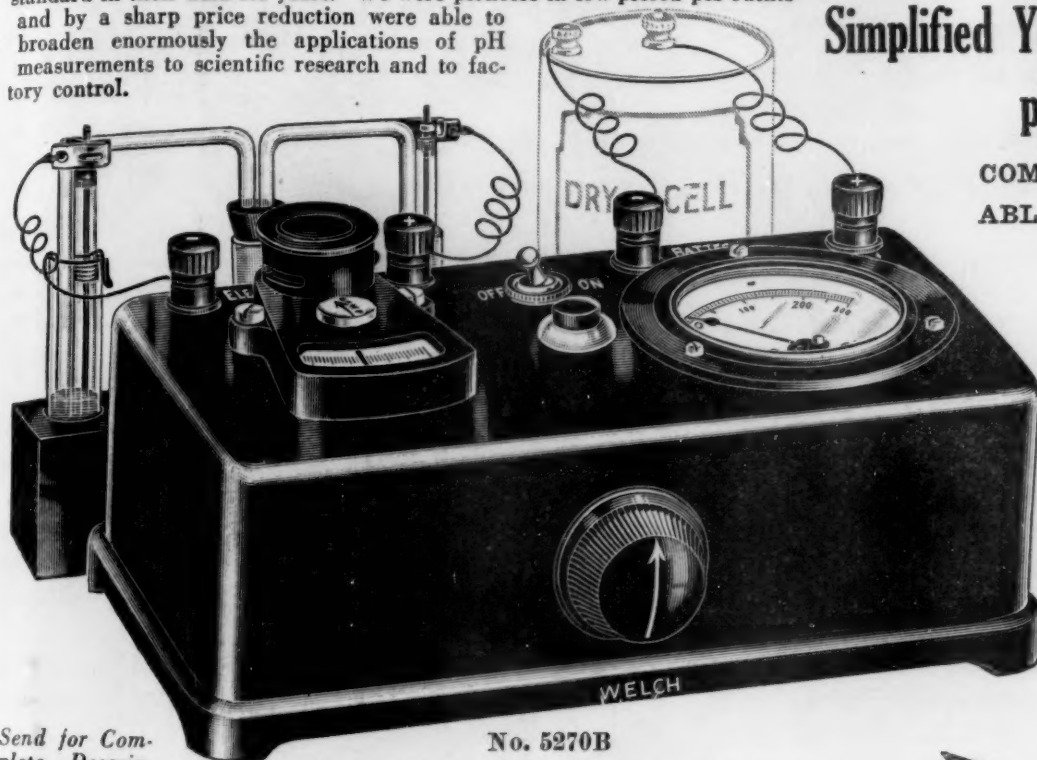
High velocity air currents in thunderstorms help to produce lightning by separating positive and negative ions in the atmosphere; found by Dr. Ross Gunn, Naval Research Laboratory.

Enormous voltages are not necessary to lightning, according to high speed photographs taken by Drs. B. F. J. Schonland, D. J. Malan and H. Collins, of South Africa, who note the stroke proceeds by series of steps.

A new instrument developed by Dr. Harry H. Hall, Croft Laboratory, Harvard University, analyzes the quality of sound in four seconds instead of several days as required by older methods.

A world-wide survey of natural radioactivity was proposed by Dr. V. I. Vernadsky, USSR Academy of Sciences, as an aid in determining the distribution of rocks of various geologic ages and in locating helium deposits.

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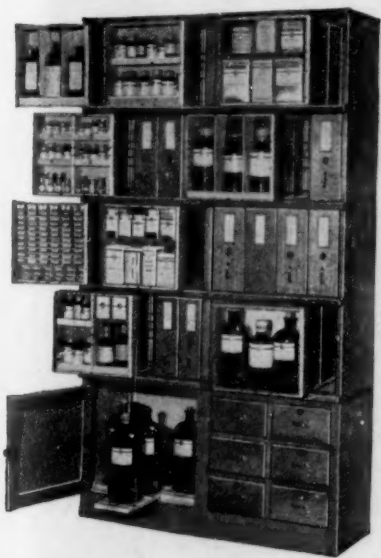
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A new type of alternating current bolometer for measuring minute amounts of radiation, which overcomes the handicaps of sensitive galvanometers used previously, was developed by Professor P. H. Moon, of the Massachusetts Institute of Technology.

Chemistry

The heavy isotope of neon, mass 22, was concentrated to 99 per cent. purity by Dr. Gustav Herz, of Berlin.

Work by Professor F. W. Aston, University of Cambridge, has indicated some 20 new isotopic varieties of chemical elements, bringing the total number of known isotopes to 247 stable varieties among 79 of the 92 elements.

First definite proof of the existence of a super-heavy element beyond No. 92 in the periodic table was obtained by Dr. Aristid V. Grosse, University of Chicago.

With an improved mass spectrograph Professor A. J. Dempster, University of Chicago, obtained, for the first time, evidence of the existence of isotopes of gold and platinum.

Because atomic weights depend on the proportions of the various isotopes of the element present, further work in this once-important chemical field was held useless by Professor Harold C. Urey, Columbia University.

By "boiling down" 75 tons of water over a period of a year, ten drops of precious liquid containing a high concentration of the rare hydrogen isotope of mass three was obtained at Princeton University.

Heavy water, made of ordinary hydrogen combined with the heavy isotope of oxygen, was announced by J. B. M. Herbert and M. Polanyi, University of Manchester, England.

Using heavy water molecules as "tracers," Professor George von Hevesy and E. Hofer, of the University of Freiburg, Germany, showed half the amount of any drink of water is still in the human body after nine days.

Evidence of "lost" chemical elements no longer present on the earth was found by Professor George H. Henderson, Dalhousie University, Halifax, from study of halos in mica formed by radioactivity.

New discoveries about the chemical structure of vitamin B, by Dr. R. R. Williams and his coworkers at Columbia University led to hope that it may be synthesized.

Huge reserves of carbon dioxide gas, from which "dry ice" is made, were discovered near Imperial Valley in California.

A chemical method of plasticizing rubber in place of more expensive mechanical chopping and crushing was developed by Ira Williams and C. C. Smith, E. I. du Pont de Nemours and Company.

A new process of purifying potash, developed by chemists of the U. S. Bureau of Mines, holds the hope of freeing America from the necessity of potash imports in event of war.

A mixture of di-phenyl and di-phenyl oxide, chemical cousins of the synthetic geranium perfume, is being used to replace water in steam boilers for increased efficiency, as reported by C. G. Brown, G. A. Gaffert, P. H. Konz and D. S. Ullock, University of Michigan.

Astronomy

Nova Herculis, the star that flared up to extraordinary brilliance, just before Christmas, 1934, was studied intensively, while it remained visible to the unaided eye until April, then it faded, and later became brighter again.

A new outpost of the universe, a faint nebular galaxy of stars, three sextillion miles (500,000,000 light years) from earth, with recession velocity of 50,000 miles per second was discovered at Mount Wilson Observatory.

Professor I. S. Bowen, California Institute of Technology, brought forward clear proof of how the formerly mysterious nebular lines are practically all radiations of very common elements excited in peculiar but now understandable ways to emit radiations that they do not emit under conditions existing at the earth's surface, thus finally resolving an 80-year-old enigma.

Electronic tides high in the atmosphere, supposedly caused by the moon, were investigated through effects on radio by Dr. Harlan T. Stetson, Harvard College Observatory.

X-rays from the sun that never reach the earth were deduced from radio observations by Dr. Ernst A. W. Müller, Siemens Halske Co., Berlin.

Cosmic rays were suggested as the cause of the night light of the sky by Dr. Joseph Kaplan, University of California at Los Angeles.

An age of 10,000 billion years for the universe was estimated by Sir James Jeans, British astronomer.

Streamers from the sun for distances up to 500,000 miles were discovered by Dr. Philip C. Keenan, Yerkes Observatory, and called signposts to sun-spots.

A peculiar radio disturbance in the illuminated part of the earth every two revolutions of the sun was noted by Dr. J. H. Dellinger, of the National Bureau of Standards.

Discovery of a dwarf star that may be one of the sun's half dozen nearest neighbors was made by Dr. W. J. Luyten and E. G. Ebbighausen, University of Minnesota.

Omega Centauri, one of the most renowned of all globular clusters, was found to be three times as large as previously estimated, as a result of measurements by Drs. Harlow Shapley and A. R. Sayer, Harvard University.

An expansion-speed of the universe, which nearly doubles previous values, was deduced by Sir Arthur Eddington.

Thousands of faint galaxies in the Horologium region were located by Dr. Harlow Shapley of Harvard Observatory.

The properties of transmutations suggest that the internal temperatures of stars are 1,000,000,000 degrees Centigrade, Dr. T. E. Sterne, Harvard, computed.

Solar activity increased and the largest sun-spots groups in five years were observed.

The world's second largest stony meteorite, 700 pounds, was found in southwestern Kansas.

New comets were discovered by Professor G. Van Biesbroeck, Yerkes Observatory, and by Drs. Cyril Jackson and E. L. Johnson, Johannesburg, South Africa.

An asteroid with large eccentricity and high angle of orbit, with period of revolution around the sun of six years, was discovered by Dr. Edwin P. Hubble, Mount Wilson Observatory.

Hidalgo, little object that looks like an asteroid and travels like a comet, was rediscovered.

Comas-Sola comet was rediscovered by Dr. Hamilton M. Jeffers, Lick Observatory.

Dunlap Observatory of the University of Toronto, with a 74-inch diameter reflecting telescope, world's second largest, was completed.

A new telescope mirror shaping method using aluminum deposition was developed by Dr. John Strong and Professor Enrique Gaviola, California Institute of Technology.

Hayden Planetarium of the American Museum of Natural History was opened.

Casting and annealing of the disk for the mirror of the 200-inch diameter telescope of California Institute of Technology was completed at Corning, N. Y.

Dome of the McDonald Observatory on Mount Locke, Texas, joint project Universities of Texas and Chicago, was completed.

An aluminum instead of a silver coating was given the mirror of the 100-inch telescope on Mount Wilson.

The International Astronomical Union met at Paris. Astronomical results were published in Turkish for the first time.

Earth Sciences

The entire northeastern part of the United States felt, on November 1, an earthquake that centered near Lake Nipissing, in northern Ontario.

A series of destructive earthquake shocks damaged Helena, Mont., during the last ten days in October.

A local earthquake was felt at the Grand Canyon of Arizona on January 15.

A total of 25 earthquakes was recorded by seismographs in the United States.

Disastrous earthquakes, killing thousands of people, visited Formosa a few days before Easter, and northern India on May 31.

Correlation between the position of the moon and the occurrence of deep-focus earthquakes was demonstrated by Professor Harlan T. Stetson, working at Harvard College Observatory.

Mauna Loa, Hawaii's loftiest active volcano, erupted a stream of lava on November 23, but caused only minor damage.

Vesuvius was in eruption, emitting streams of lava.

A volcanic crater in the Pinacate region in Sonora, Mexico, just across the U. S. boundary, was reported in eruption in January.

An expedition of the Carnegie Institution of Washington studied volcanoes in Central America.

The U. S. Weather Bureau's hurricane service was reorganized, with three stations at San Juan, P. R., Jacksonville, Fla., and New Orleans, La.

A total of 5 hurricanes was recorded from southern waters.

Florida was twice swept by destructive hurricanes.

The record-breaking Great Drought apparently ended; precipitation decidedly above normal caused serious delays both in spring planting and in fall harvesting; and

there were serious floods on some of the Plains rivers.

Dust storms again raged in the west, during early spring.

A persistent fog over almost the entire east and mid-west held up all air traffic for nearly a week in January.

Two villages were destroyed by an ice-avalanche in northern Russia, with a loss of 88 lives.

The establishment of a central governmental map-making body, combining the work of a number of scattered bureaus, was recommended by the Science Advisory Board.

A remarkable series of educational films illustrating geological processes was made, as a cooperative enterprise of the U. S. National Park Service, the University of Chicago, and Erpi Picture Consultants, with the aid of CCC workers.

Preparations were made for digging a ship canal across northern Florida.

The Great Geyser of Iceland, prototype of all geysers, resumed eruptions, after a quiescent period since 1914.

Mysterious Easter Island and "Robinson Crusoe's Island" in the Juan Fernandez group were set aside as national parks by the Chilean government.

An expedition from the Hawaiian Academy of Science climbed Mauna Kea, the highest peak in the islands, and spent a week at its summit.

Soviet expeditions penetrated the Arctic Ocean north of Russian territory, discovering a number of islands and breaking a path through to Bering Strait.

Lincoln Ellsworth, noted explorer, made several new discoveries in Antarctica, but appeared to be lost in an attempt to cross the frozen continent by airplane.

Seismic soundings by the Byrd Expedition determined the thickness of the ice sheet over parts of Antarctica.

A large air photo map, comprising the entire state of Connecticut, was completed.

The American Geographical Society of New York completed the first of a series of Northern Labrador map sheets that embrace 5,000 square miles.

The one to one millionth map of Hispanic America by the American Geographical Society of New York, the largest mapping enterprise by a non-governmental organization, was brought to a conclusion after 15 years of work.



Addition of daily airplane flights to 15,000 foot altitude at about 20 locations allowed the U. S. Weather Bureau to combine air mass analysis with other methods of weather forecasting as recommended by the Science Advisory Board.

Mammoth and Dixon Caves in Kentucky were demonstrated to be part of the same cave complex, by Dr. E. R. Pohl, technician of the Emergency Conservation Work.

Lunar tides in the solid earth, altering the distance between Europe and America by as much as 63 feet in a year, were shown to exist by Professor H. T. Stetson, astronomer, and Dr. A. L. Loomis, physicist, working in the latter's private laboratory at Tuxedo, N. Y.

A device for taking sample cores of seabottom was developed by the Carnegie Institution of Washington, the Geological Society of America and the du Pont Powder Company.

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